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VOLUME 41 FEBRUARY, 1931 NUMBER 2

IS FAMILIAL JAUNDICE OF NEW-BORN INFANTS ERYTHROBLASTOSIS?

REPORT OF TWO CASES *

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AND
HEYWORTH N. SANFORD, M.D.
CHICAGO

Familial jaundice of new-born infants was first described by Pfannenstiel.[1] The clinical features are afebrile jaundice, peculiar to certain families and the tendency to occur in successive pregnancies. The children appear to be normal at birth, but they die a few days later as the result of a grave and progressive icterus. The stools are not acholic, but the urine usually contains bile pigment. The liver and spleen are enlarged as a rule. Death following a collapse usually occurs in a few days.

Abt [2] stated that the condition has nothing in common with Winckel's or Buhl's disease; that, in a sense, the children are defective, and that they soon become incapacitated to carry on extra-uterine life. He did not believe that the condition is due to an injury at birth or to toxemia of pregnancy. Rolleston,[3] in a study of 25 family groups, found that in 15 of the 130 cases of familial icterus gravis the mother had recurrent jaundice during pregnancy. He, therefore, considered that toxemia of pregnancy may be a cause. Knopfelmacher [4] stated the belief that a septic process might explain the conditions, as did Thorling.[5]

The many cases of familial jaundice appearing in the literature have separated it from the loose classification of undetermined jaundices of new-born infants with fatal termination called icterus gravis. The his-

* Submitted for publication, Aug. 27, 1930.

* From the Department of Pediatrics, Rush Medical College, University of Chicago, and the Presbyterian Hospital.

1. Pfannenstiel, J.: Ueber den habituellen Ikterus gravis der Neugeborenen, München. med. Wchnschr. **55**:2169, 1908.

2. Abt, I. A.: Familial Icterus of New-Born Infants, Am. J. Dis. Child. **13**:231 (March) 1917.

3. Rolleston, H.: Grave Familial Jaundice of the Newly-Born, Practitioner **104**:1 (Jan.) 1920.

4. Knopfelmacher, W.: Der habituelle Icterus gravis und verwandte Krankheiten beim Neugeborenen, Ergebn. d. inn. Med. u. Kinderh. **5**:205, 1910.

5. Thorling, I.: Grave Familial Jaundice in the New-Born, Uppsala läkaref. förh. **28**:1 (Oct.) 1922.

tory of a familial tendency is the only distinctive feature. There is nothing in the clinical picture to warrant the separation, and the pathologic observations are not different. Nuclear icterus has also been differentiated from icterus gravis on the basis of the icteric staining found in the nuclear region at autopsy. Huwer [6] expressed the belief that nuclear icterus is caused by a congenital or hereditary abnormality of the fetal hematopoietic system, resulting in intravascular destruction of the blood. There are many clinical symptoms of familial jaundice of new-born infants that point to an abnormality of the hematopoietic system; yet, strangely, most of the cases reported are without adequate studies of the blood. For this reason, the following cases are reported.

REPORT OF CASES

Case 1 (W. L. B.).—Thelma T., a white female infant, was born at the Chicago Memorial Hospital on Feb. 17, 1930. The family history was significant in that the first child that had been born in this family was jaundiced at birth; but it recovered, being now 6½ years old and in good health. The second and third pregnancies resulted in full-term, normal-appearing infants, in both of whom a severe jaundice with hemorrhage developed, and who died on the fifth and fourteenth days, respectively. The patient was the product of the fourth pregnancy, being from two to three days beyond term. The labor was short, and the weight at birth was 3,440 Gm. The health of the mother had been good throughout the pregnancy. The Wassermann reaction of both the mother and the father had been negative on repeated examinations. Examination of the child at birth showed a moderately generalized icterus, a slight internal strabismus and some distention of the abdomen. The skin over the abdomen appeared glossy and edematous, but it did not pit under pressure. The liver was palpable at two fingerbreadths below the costal margin in the mammary line; in the midaxillary line, the tip of the right lobe extended almost to the crest of the ileum. The tip of the spleen was barely palpable. No adenopathy or hemorrhages were noted. The child seemed bright and it cried lustily. Examination of the blood five hours after birth showed: hemoglobin, 50 per cent (Sahli); red cells, 2,950,000; nucleated cells, 474,000, of which 45 per cent were nucleated red cells. The differential count showed 14 small lymphocytes, 1 eosinophil and 85 neutrophils, many of which were immature. The blood platelets numbered 266,000; the coagulation time was four and one-half minutes and bleeding time was two minutes. The Wassermann and Kahn reactions of the blood were negative. A culture of the blood showed no growth. The resistance to a hypertonic salt solution was slightly increased. The indirect van den Bergh reaction was positive, and the direct reaction was negative. Roentgenograms of the long bones showed no changes. The blood of the father, the mother and the infant was of group IV Moss. On the following day, the jaundice was more intense, but the general condition remained good. On February 19, the child appeared weak; it would not nurse and the jaundice was more intense. The spleen was palpable and slightly larger. Fifty cubic centimeters of citrated blood from the father was given intraperitoneally at this time. On the following day the child seemed brighter and it nursed fairly well. The amount of hemoglobin and red cells

6. Huwer, G.: Nuclear Icterus of the New-Born Infant, Ztschr. f. Geburtsh. u. Gynäk. 94:150 (Sept.) 1928.

remained unchanged, but the nucleated cells dropped in number to 48,000, of which 30 per cent were nucleated red cells. On February 24, the jaundice was less intense, the nucleated red cells had disappeared, and the general condition was improved. The urine showed albumin and urobilin; chemical examination of the stools on one occasion showed blood. The stools were always dark. On the succeeding day the jaundice gradually faded, but the child became weaker, and the anemia became progressively worse. On March 1, a second intraperi-

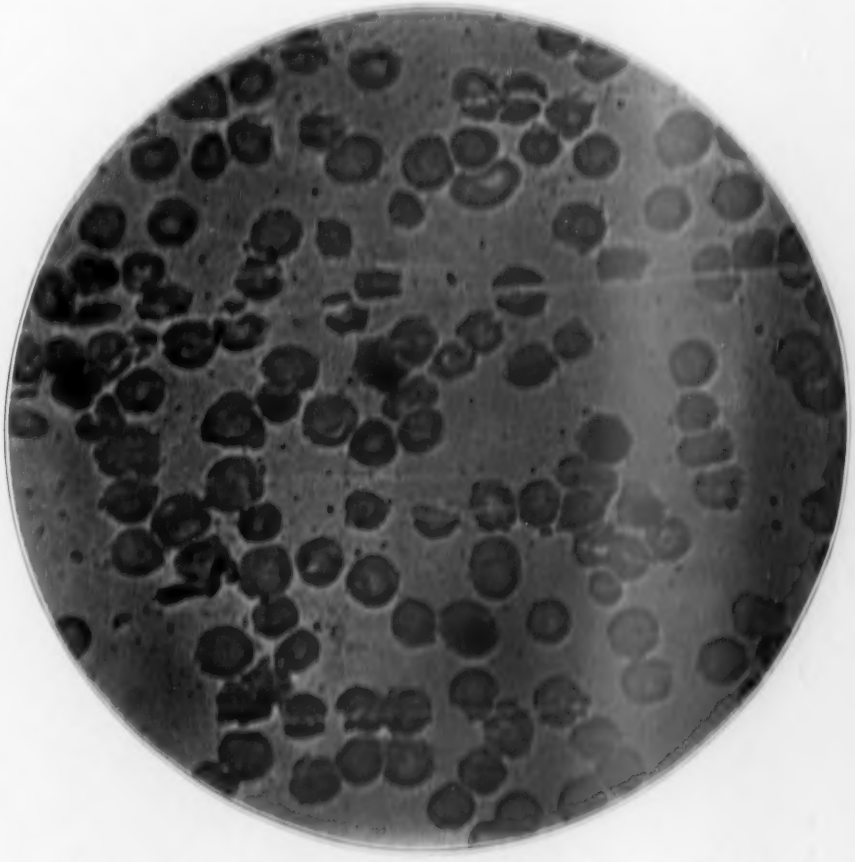


Fig. 1 (case 1).—A smear of blood taken the second day, showing erythroblasts; × 400.

toneal transfusion was performed with good temporary results. The child at this time had a light lemon-yellow skin—the subicteric tint of pernicious anemia. Because the hemoglobin had fallen to 58 per cent and the red cells to 2,500,000, with 2 per cent nucleated red cells and 11,000 white cells, a third intraperitoneal transfusion of the blood was performed on March 21. This time the blood was taken from the mother. A few hours later the respiration became rapid and "grunting." A systolic murmur that had previously been noted over the base and apex of the heart became more audible, the abdomen was distended, and death occurred ten hours after the last transfusion.

Autopsy.—The skin and mucous membranes were extremely pale and had a subicteric, pale lemon-yellow tint. The heart was somewhat hypertrophied, and the ductus arteriosus and the foramen ovale were patent. The lungs showed an early bronchial pneumonia. The liver was about normal in size. On section, the architecture was easily made out, owing to the prominence of the central zones, which were seen as red dots and streaks. In some areas the surfaces were grayish green, and the architecture was indistinct. The cystic duct and common

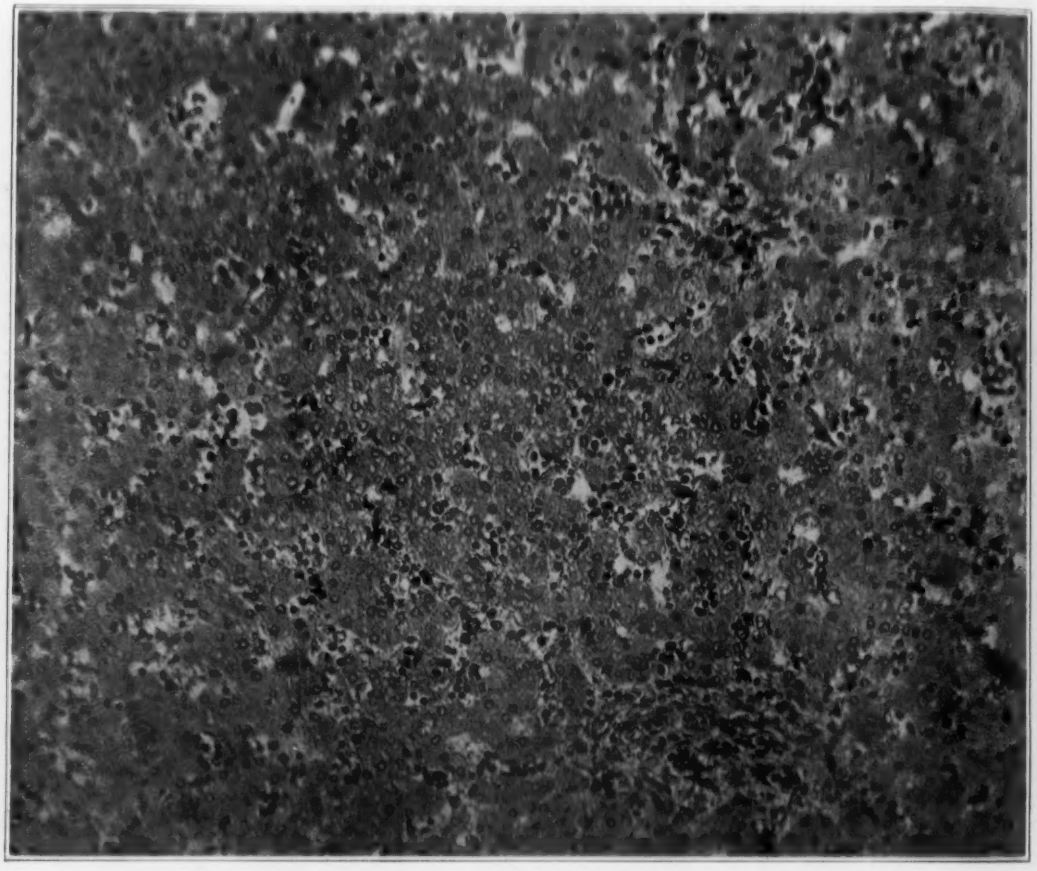


Fig. 2 (case 1).—Photomicrograph of a section of the liver showing erythropoiesis; × 170.

duct were carefully dissected and were found to be free of pathologic changes. The spleen was enlarged, measuring about 10 by 8 cm. and about 6 cm. in diameter. It was a dark reddish brown, and extremely soft; when it was cut, the capsule split and the splenic pulp was almost mushy. The entire brain was markedly anemic and rather firm.

Anatomic Diagnosis.—The anatomic diagnosis was acute splenic hyperplasia, marked icterus and hyperplasia of the bone-marrow.

Microscopic Examination.—The small capillaries of the heart were crowded with round cells which were, for the most part, cells of the myelogenous series. These consisted of polymorphonuclear leukocytes, eosinophilic myelocytes and large cells with granular cytoplasm and pale vesicular nuclei.

The cells of the liver were pale and granular and the membrane of the cells was distinct. In some fields, the cells contained small granules of greenish pigment. Throughout the entire liver, there were innumerable small areas consisting of groups of cells similar in appearance to those described in the capillaries of the heart. In the liver the polymorphonuclear myelocytes were more abundant than in the vessels of the heart.

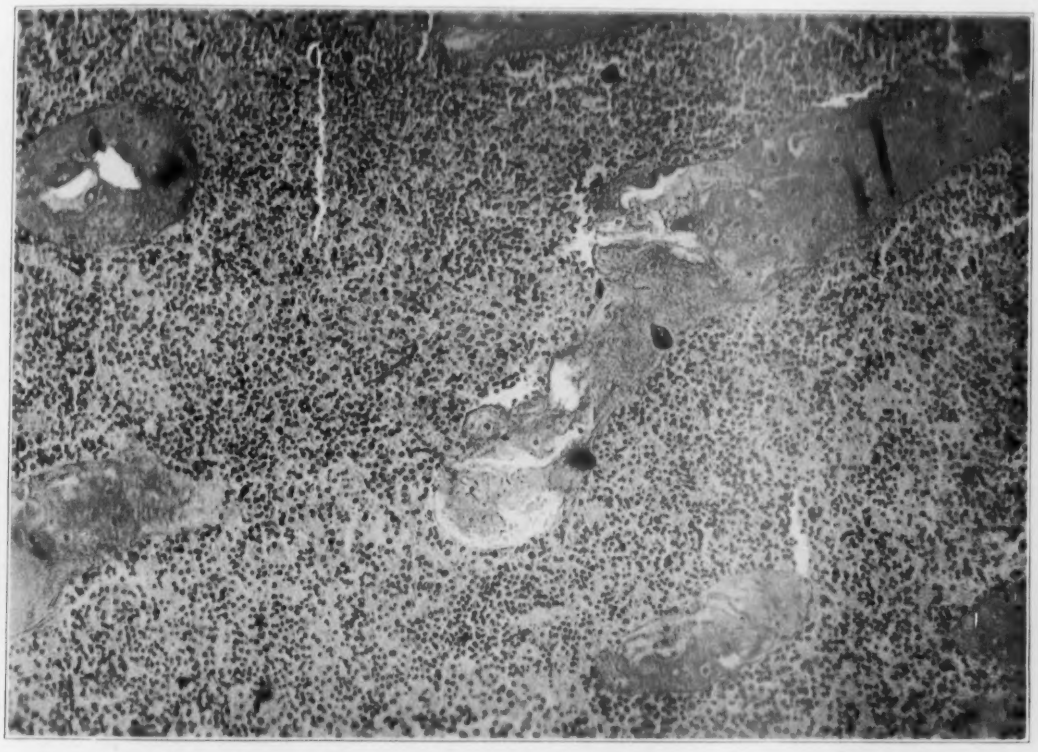


Fig. 3 (case 1).—Photomicrograph of a section of bone-marrow, showing hyperplasia and crowding with myelogenous cells; × 170.

The splenic corpuscles were smaller than the normal, and they were merged with the surrounding pulp instead of being sharply demarcated. The pulp was crowded with red and with white blood cells, for the most part identical with those described in the previous organs.

Sections of the lymph nodes showed the presence in the pulp of a diffuse infiltration of the cells of the myelogenous series.

The substance of the brain proper was without histologic change.

The bone-marrow was crowded with innumerable cells of the myelogenous series. These varied from young myeloblasts to adult polymorphonuclear leuko-

cytes, eosinophils and basophils. Numerous megokaryocytes and nucleated red blood cells were seen. In addition, there were very many typical polymorphonuclear leukocytes.

Microscopic Diagnosis.—The microscopic diagnosis was erythropoiesis; blood-forming islands in the liver and hyperplasia of the spleen and the bone-marrow.

CASE 2 (H. N. S.).—F. V., a white male infant, was born at the Presbyterian Hospital on June 6, 1930. The mother was a quintipara, with four living children. Two boys had been markedly icteric at birth, and they had received blood intramuscularly. The mother was 33 years of age; she had had a blood pressure of

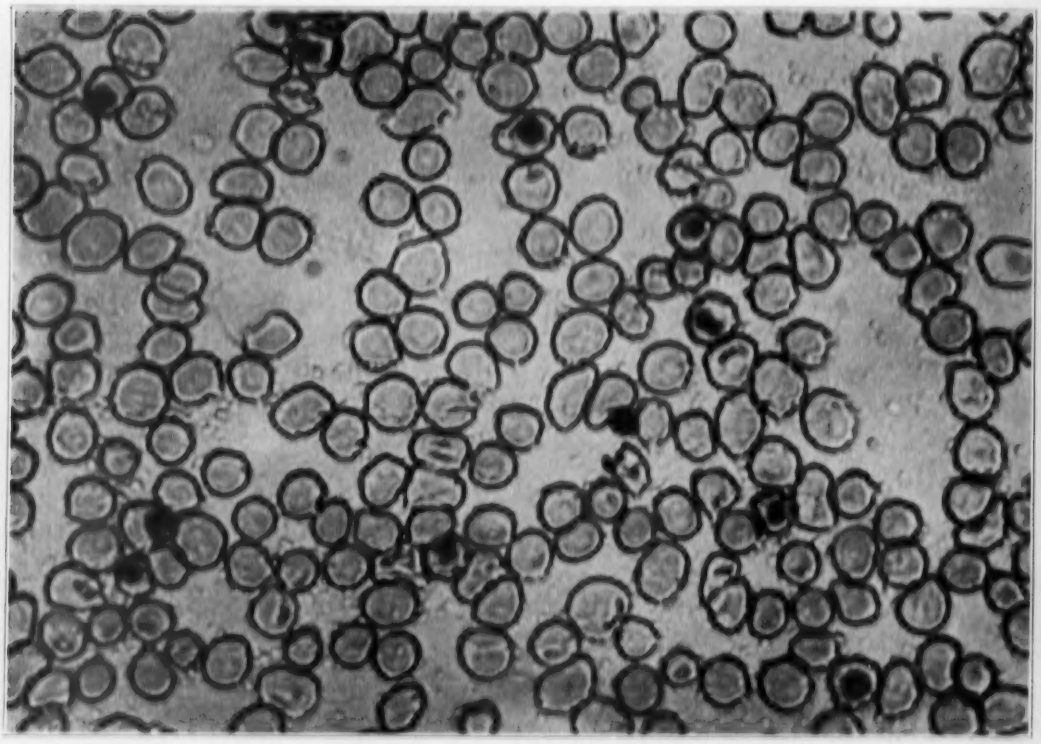


Fig. 4 (case 2).—A smear of blood taken the first day, showing erythroblasts; × 400.

152 systolic and 90 diastolic during the last week of pregnancy. At this time, her urine showed 2 plus albumin and 4 plus sugar. The Wassermann reaction of both parents had been negative on repeated examinations. The mother had been jaundiced several weeks before delivery. The delivery was normal, occurring in three hours. The child weighed 3,576 Gm. An examination made six hours after birth showed a large baby with a third degree jaundice. The trunk was covered with numerous large areas of subcutaneous hemorrhage. The anterior fontanel was small and almost closed, and there was considerable over-riding of the parietal bones. The posterior fontanel was closed. The conjunctiva was markedly icteric, and the disks were shallow. The abdomen was large and tense, its circumference being 35 cm. as compared to 34 cm. of the chest and 34.5 cm.

of the head. The liver was palpable at 2 cm. below the costal margin, and the spleen was barely palpable. Examination of the heart and the lungs showed no pathologic conditions. The reflexes were sluggish. Examination of the blood showed: hemoglobin, 47 per cent (Newcomer); red blood cells, 1,510,000 and nucleated cells, 150,000. Of these, 90 per cent were nucleated red cells, leaving 10,500 white cells. The differential count showed: polymorphonuclears, 51 per cent; small lymphocytes, 36 per cent; large lymphocytes, 6 per cent; eosinophils,

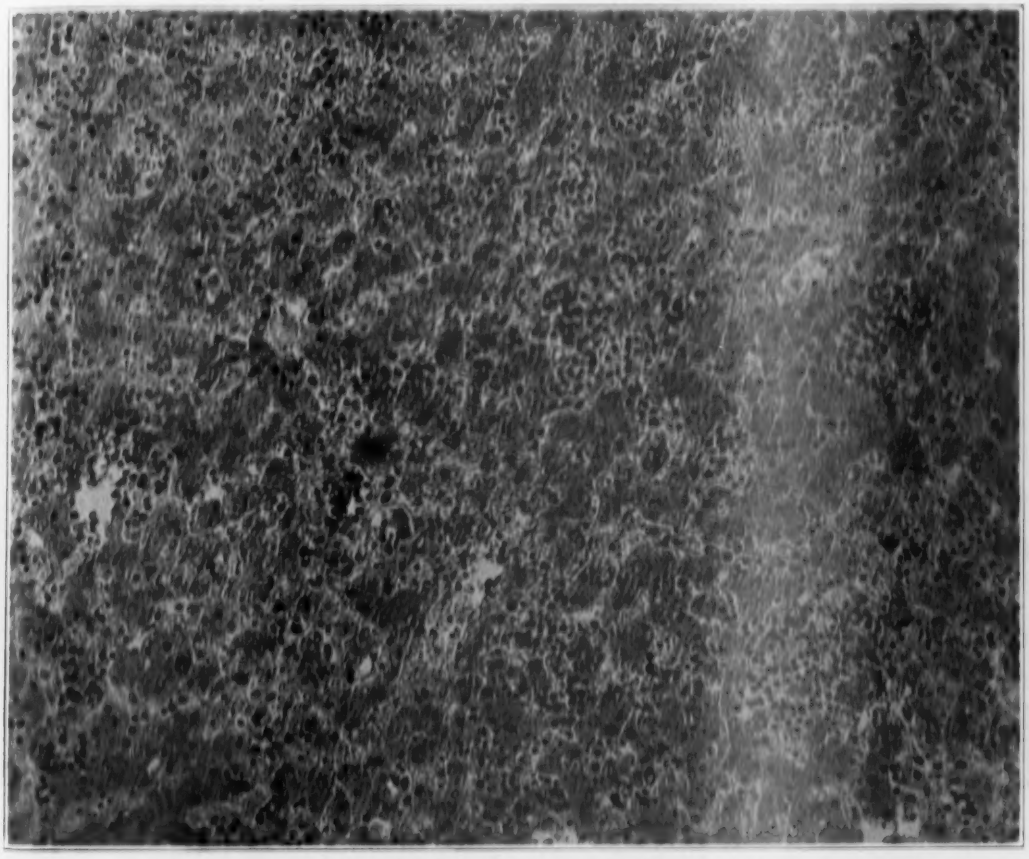


Fig. 5 (case 2).—Photomicrograph of a section of the liver, showing nucleated erythrocytes between the hepatic cords; × 170.

2 per cent and myelocytes, 5 per cent. The platelets numbered 60,000; the coagulation time was four minutes, and the bleeding time was thirty-eight minutes. The indirect van den Bergh reaction was positive, and the direct reaction was negative. Roentgenograms of the long bone showed no changes. The urine contained considerable urobilin and bilirubin. Forty-five cubic centimeters of blood from the mother was given intraperitoneally, and protein milk was given by a tube. The condition of the child gradually grew worse, and death occurred thirty hours after birth.

Autopsy.—The body was that of a white male infant, 2 days old and weighing 7 pounds (3,175 Gm.). The muscles were soft; the subcutaneous tissues were edematous, and there were only islands of subdermal fat. The liver was 5 cm. below the right costal margin, 3 cm. below the tip of the xiphoid and flush with the costal margin on the left.

The peritoneal cavity contained 25 Gm. of clotted blood, and there was 10 cc. of bloody, watery fluid below the diaphragm. The thoracic cavity was free from fluid. The pericardial cavity contained 25 cc. of turbid yellow-brown-red fluid. The lungs were atelectatic, but crepitated. The brain was edematous and soft.

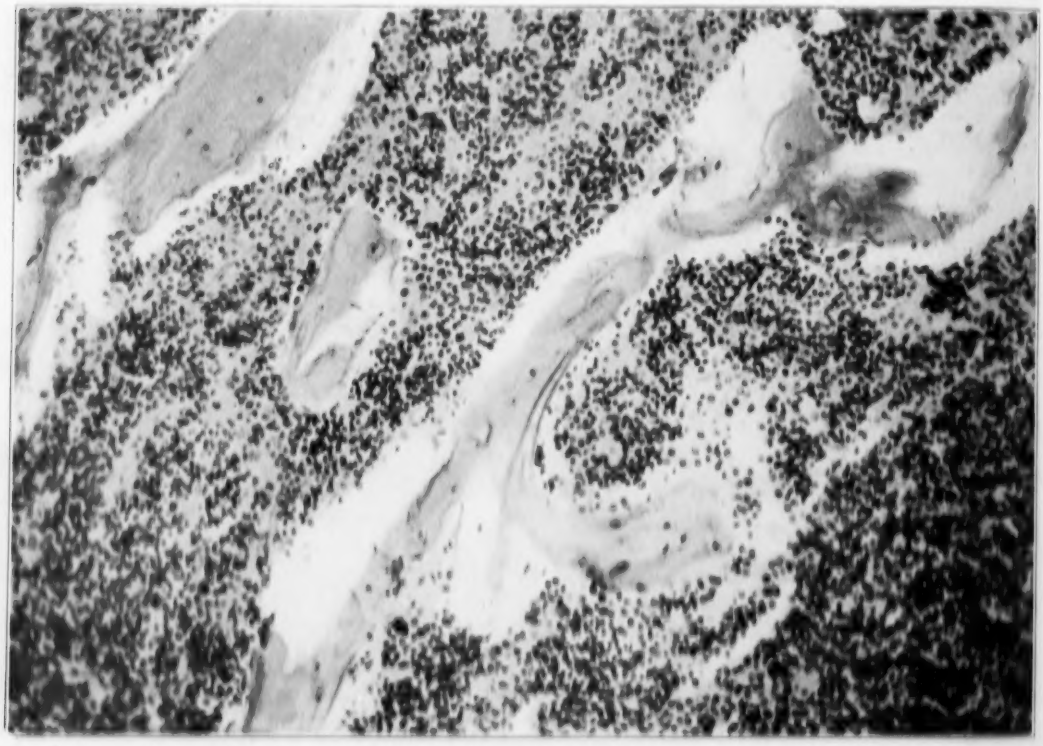


Fig. 6 (case 2).—Photomicrograph of a section of the liver, showing hyperplasia and erythroblastic cells; × 170.

The liver weighed 220 Gm. and was a dull purplish red. The surfaces made by cutting showed distinct yellow blood vessels cut transversely. The gallbladder contained about 15 cc. of fluid. The common bile duct was patent; it was 3 mm. in circumference.

The spleen weighed 50 Gm.; it was semisolid and a deep purplish red, the surfaces that were cut were sprinkled with distinct trabeculae of connective tissue. The bone-marrow was very red.

Anatomic Diagnosis.—The anatomic diagnosis was generalized icterus; general anemia; edema of the subcutaneous tissues of the brain and of the wall of the gallbladder; hemoperitoneum; hyperplasia of the spleen; petechial hemorrhages of the diaphragm and spleen, and hyperplasia of the marrow of the long bones.

Bacteriology.—No organisms were found in the smears of the peritoneal fluid. There was a moderate growth of *Staphylococcus albus* in the cultures of the fluid from the peritoneal cavity on aerobic and anaerobic blood agar and dextrose broth.

Histology.—In the sections of the cancellous portion of one femur, the spaces were completely filled with active marrow. Under a low power microscope, the majority of nuclei were round. There were few polymorphonuclear leukocytes. With higher magnification, at least 75 per cent of the nuclei were those of erythroblasts. The cytoplasm of the majority stained with eosin.

In the sections of the kidney there were no noteworthy changes, except that the cells of the convoluted tubules were swollen, and the nuclei were stained less intensely than those of the glomeruli.

In the sections of the liver, about twenty-five regions containing clumps of cells between the hepatic cords were in every low power field. The majority of the cells were nucleated erythrocytes, but in addition, there were polymorphonuclear leukocytes in some, whereas, in others the cells were characterized by large oval nuclei and scant cytoplasm.

In the sections of the kidneys that had been stained with sudan III, there were no regions that retained the stain. In similar sections of the liver, however, at least two thirds of all the hepatic cells contained small red granules.

In the sections of the myocardium, the nuclei of the muscle bundles stained distinctly with hematoxylin and eosin, but the striations of the muscle bundles were indistinct and irregularly vacuolated. The alveoli in some portions of the lungs were incompletely distended because the diameter of the walls was equivalent to the diameter of the sac in many places.

In sections of the spleen, the vascular spaces were greatly dilated. The malpighian corpuscles were sparse in cells. Multiple small masses of chromatin were seen throughout the spleen; a few of them were surrounded by cytoplasm stained with eosin, but the majority appeared to be free of cytoplasm. The framework of fibrous tissue of the spleen was delicate. Approximately one half of all the nucleated cells were characterized by large irregular nuclei with scant chromatin, and they contained one or two nucleoli. The majority of erythrocytes in the vascular spaces of the spleen did not have nuclei.

Histologic Diagnosis.—The histologic diagnosis was erythropoiesis; blood-forming islands in the liver; fatty changes of the liver; cloudy swelling of the kidneys and of the myocardium; slight fetal atelectasis of the lungs and hyperplasia of the bone-marrow.

COMMENT

From the clinical picture and the family history, both of these cases fall into that group of icterus gravis known as familial jaundice. The absence of pathologic icterus in the tissues of the brain rules out the group of nuclear icterus. These cases differ from those previously reported by the intense erythroblastosis. The anemia of familial jaundice of new-born infants is not a new observation; Zahorsky [6a] reported the case of an infant with the clinical picture of familial jaundice in whom the blood showed 42 per cent hemoglobin and 2,050,000

6a. Zahorsky, T. S.: A Case of Congenital Hemolytic Icterus, Proc. St. Louis Pediat. Soc., Nov. 4, 1927.

red cells. After a transfusion with 90 cc. of citrated blood, the count on the twenty-first day had risen to 60 per cent hemoglobin and 3,500,000 red cells. Gregory [7] reported a case of jaundice in a new-born infant in whom the hemoglobin was 30 per cent, the red cells numbered 1,605,000, and the white cells, 13,200 with many nucleated red cells. This child was living at 1 month of age.

The immense increase in nucleated erythrocytes has not been previously reported. Gregory stated that there were many nucleated red cells in the blood of the patient whom he and Struthers observed; [8] Hart [9] and Rosenbaum [10] reported typical cases of familial jaundice of new-born infants in whom nucleated erythrocytes were noted. Nucleated erythrocytes are not an uncommon observation in the blood of new-born infants in the first week of life; counts of 100 cells will usually show from 5 to 10 erythroblasts.

In our first case there were 213,000 nucleated red cells and in the second, 140,000. These cases were clinically familial jaundice of new-born infants having a family history of jaundice at previous pregnancies, intense jaundice at birth, which was progressive, stools that were not acholic and bile pigments in the urine. That these symptoms were due to a destruction of the blood is shown by the anemia, the indirect van den Bergh reaction, bile pigments in the urine and erythroblastosis. The observations at autopsy further confirmed this by the erythropoiesis in the liver and in other organs, the patent ducts of the gallbladder, and the hyperplasia of the bone-marrow.

Of the various theories of hemolytic jaundice, Zieman [11] has listed hepatogenic, congenital fragility of the red cells; spondogenous, splenomegalic, heptosplenic hemolysis and a dysfunction of the reticuloendothelial organs or structures. Klemperer,[12] in carefully performed autopsies of three infants with the clinical picture of icterus gravis, found necrosis with diffuse but not focal destruction of the cells of the liver, which was the most conspicuous in the central areas of the lobules. In our cases, the pathologic process of the liver consisted of numerous

7. Gregory, H. H. C.: Anemia and Jaundice in a New-Born Child, Proc. Roy. Soc. Med. **22**:136 (Dec.) 1928.

8. Struthers, R. R.: A Case of Haemolytic Jaundice in the Newborn, Canad. M. A. J. **16**:1221 (Oct.) 1926.

9. Hart, A. P.: A Familial Icterus Gravis of New-Born and Its Treatment, Canad. M. A. J. **15**:1008 (Oct.) 1925.

10. Rosenbaum, H. A.: Familial Icterus of Newborn; Report of Case, Arch. Pediat. **45**:621 (Oct.) 1928.

11. Zieman, E.: Pathogenesis of Hemolytic Jaundice, Časop. lék. česk. **64**: 916 (June) 1925.

12. Klemperer, P.: Icterus Gravis of New-Born, Am. J. Dis. Child. **28**:212 (Aug.) 1924.

islands of blood-forming myelogenous cells, while the spleen showed acute hyperplasia, with intensely active bone-marrow.

Ylppö [13] was unable to see reason for differentiating familial jaundice from the ordinary icterus neonatorum, because he considered this condition to be simply a continuation of the fetal function of the liver. Icterus neonatorum is of such frequency that jaundice appearing several times in a family might easily fall within the possibilities of chance. In many of these cases in which autopsy has shown definite destruction of tissue of the liver, prenatal influences, or congenital metabolic anomaly as well as infection might be a cause. Hampson [14] reported eighteen cases of familial jaundice with seventeen recoveries after the use of blood serum. He believed that these were all due to prenatal influences, similar to the observation of Rolleston. Cases of icterus gravis with recovery such as those reported by Greenwald and Messer [15] might fall into this class. In our cases we observed clinically an intense jaundice, and by examination of the blood, we noted an extreme erythroblastosis. This jaundice is obviously caused by hemolysis of the red blood cells, as shown by the anemia, bile pigments in the urine, the indirect van den Bergh reaction and the observations at autopsy. Prenatal influences in either case can be practically ruled out, and the observations at autopsy do not show signs of infection. The picture is more one of a persisting phenomena of fetal life, as shown by the striking richness of the fetal blood-forming islands in the tissue of the liver and the numerous nucleated red blood cells in the circulation, in which the striking clinical feature of jaundice is simply a symptom of destruction of the blood.

CONCLUSIONS

Two cases of fatal jaundice in new-born infants are reported. Both cases gave a familial history of jaundice at birth. The clinical picture was one of familial jaundice with deep progressive icterus, enlarged liver and spleen, bile pigments in the urine and an indirect van den Bergh reaction. Both cases were characterized by an intense anemia with extremely numerous nucleated red cells. In one case the time of bleeding was greatly increased and there was a reduction in the blood platelets. Both patients died, and autopsy showed erythropoiesis, blood-forming islands in the liver and hyperplasia of the bone-marrow.

1305 East Sixty-Third Street.
952 N. Michigan Avenue.

13. Ylppö, A.: Ueber das familiäre Vorkommen von Icterus neonatorum gravis, München. med. Wchnschr. **85**:98 (Jan. 22) 1918.

14. Hampson, A. C.: Grave Familial Jaundice of the Newly-Born, Lancet **1**: 429 (March 2) 1929.

15. Greenwald, H. M., and Messer, W.: Icterus Neonatorum Gravis, Am. J. M. Sc. **174**:793 (Dec.) 1927.

OSSIFICATION

I. CALLUS FORMATION AND CALCIFICATION *

I. NEWTON KUGELMASS, PH.D., M.D.
NEW YORK
AND
RICHARD N. BERG, M.D.
PORTLAND, ORE.

Ossification is a local transformation of fibrous tissue into solid bone, the constituents of which are derived from the blood. The mechanism of this local chemical change is not understood, and so the problems of normal and pathologic calcification have been approached essentially from the systemic standpoint. Obviously such a procedure limits the understanding of the chemical pathology of bone. We have seen cases of obvious rickets as well as of delayed union of bone resist systemic treatment, and so we have initiated some studies on the local chemical processes involved in calcification. This paper is concerned with the relation of callus formation to calcification.

The systemic mechanism of calcification is presented graphically. Bone is a living tissue ever in equilibrium, with blood as its liquid phase. The reversible chemical system may be shifted in the direction of calcification by an increase in the blood p_H favoring the attainment of the solubility product constants of calcium carbonate and calcium phosphate. Precipitation is also favored by ultraviolet rays directly or by the presence of irradiated viosterol in the blood. The dissolution of bone producing a shift in the direction of the blood may be induced by a decreased p_H in the blood or the presence of excessive parathormone. Bone consists of a solid mixture of these calcium salts, the formation of which is inversely proportional to their solubility product constants. This equilibrium between blood and bone is distinct from that which proceeds in the alimentary tract from which the substances necessary for calcification are derived. There, the presence of the food in a sufficiently acid medium in conjunction with vitamin D prepares the substances for ready absorption in the blood. An excessive alkalinity or the presence of unabsorbed fat favors the loss of these substances into the stools in the form of calcium phosphates and calcium soaps.[1]

* Submitted for publication, July 16, 1930.

* From the Department of Research, Hospital for Ruptured and Crippled.

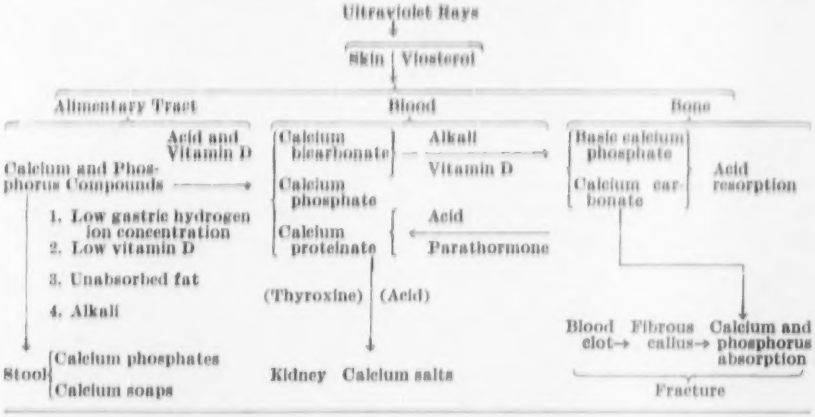
1. Kugelmass, I. N.: Arch. internat. de physiol. **21**:139 (June) 1923; Colloid Symposium, National Research Council, 1925, vol. III. Kugelmass, I. N.; Bancroft, F. W., and Stanley-Brown, M.: Determination and Regulation of Blood Clotting Function in Childhood, Am. J. Dis. Child. **39**:471 (March) 1930.

THE MECHANISM OF BONE REPAIR

The site of fracture following trauma consists of a blood clot infiltrating the surrounding tissues. The retraction of the fibrin results in a network around the fragments, which in several hours is rapidly invaded by fibroblasts. This is followed by a metamorphosis of the fibroblasts into osteoblasts with the formation of a soft or fibrous callus. This organization of connective tissue of the clot is accompanied by the formation of penetrating capillary vessels.

The vascularization is a vasomotor reaction following fracture, thus bringing about a softening and resorption of the ends of the bone, a process preparatory for their normal union. Any interference with

TABLE 1.—*The Systemic Mechanism of Ossification*



the stages preliminary to osteogenesis alters the ultimate formation of solid callus. Trabeculae of the tissue of young bone begin to appear between the periosteum and the diaphysis adjacent to the bone in the organized clot, thereby gradually producing union of the bone.

The bone in its early stages is coarse, soft and of slighter density than in its adult stages. If too great an amount of fibrous tissue is laid down in the course of callus formation, the tendency is toward nonunion, and often in the soft callus or cartilage-forming stage one will be surprised to find a large, diffuse palpable callus without any apparent calcification, as revealed by the roentgen rays. The fracture will feel fairly firm and solid; yet one is never justified in concluding that union of bone has taken place.

In certain cases refracture takes place, either accidentally or during manipulations to improve position, and it appears that new callus is formed with great rapidity. This is due to the fact that the local changes

Fig. 1.—Comparison of the gross specimens showing callus formation at the three week stage in the series of animals given injections of trypsin and tissue fibrinogen. This and the following illustrations show the initial fracture in comparison with the healing fracture at the third, fourth and fifth weeks, respectively.

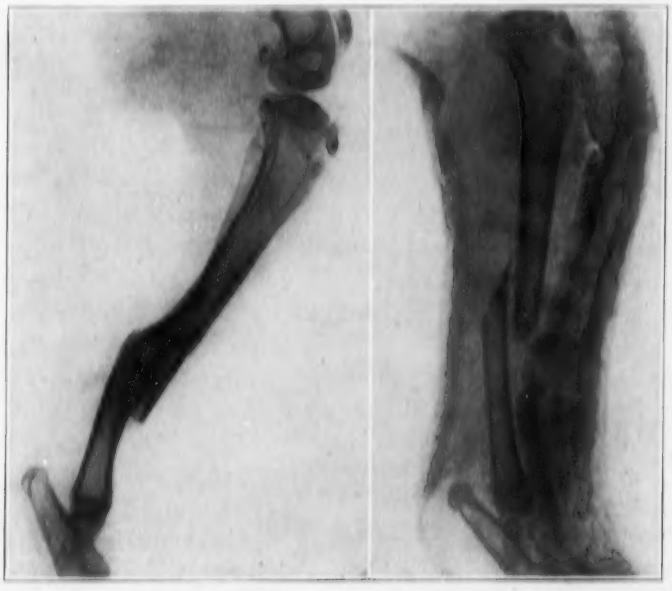


Fig. 2.—Soft callus formation at the three week stage in the control series.

necessary for this function have already been instituted, and it is only necessary to initiate the finer changes.

In the light of the local pathologic changes following trauma, it is known that a fractured bone is repaired through hemorrhage of the soft parts of the actual break in bone and through paralytic vasodilation. The hemorrhage results in clot formation, and embryonic connective tissue appears. The vasodilation produces edema in the soft tissues and resorption of the fractured ends of the bone. The calcium salts thus made available locally are absorbed by the fibrin network, which, with gradually increasing density, gives rise to bone.

TABLE 2.—*Determination of the Blood*

	Calcium, Mg. per 100 Cc.	Phosphorus, Mg. per 100 Cc.	Fibrin, Mg. per Cc. Plasma	Albumin, per Cent	Globulin, per Cent
First Series					
Trypsin group	13.0	5.6	0.12	5.1	1.4
Control group	13.0	7.8	0.14	5.3	1.5
Manipulated fracture	13.0	7.0	0.14	4.1	3.6
Second Series					
Trypsin group	13.1	5.5	0.61	4.8	2.6
Fibrinogen group	—	—	0.33	3.9	0.67
Control group	9.7	5.4	0.39	3.7	2.7
Diet group	14.3	6.7	0.25	4.2	3.3
Determinations on May 2. Second Series					
Trypsin group	15.0	4.1	0.28	4.0	3.2
Fibrinogen group	14.0	5.5	0.83	4.0	3.4
Control group	12.0	5.5	0.24	3.7	3.7
Determinations on May 7. Third Series					
Trypsin group	14.0	3.6	0.23	4.1	2.4
Fibrinogen group	14.0	3.8	0.56	4.0	2.5

THE NATURE OF DELAYED UNION

Delayed and ununited fractures have a common cause, the difference between them being only a matter of degree. The time required for union varies in the different bones, but so long as union progresses, the fracture is regarded as delayed. When organization of the exudate about the fragments is reached so that further osteogenesis is impossible, nonunion is inevitable. That causes are local rather than constitutional is proved by the fact that local treatment is effective in most cases in inducing union.

The systemic causes of nonunion are: (1) focal infection, (2) thyroid disease, (3) multiple fractures and (4) debility. The local causes of nonunion are: (1) inadequate reduction, (2) inadequate fixation, (3) circulatory interference, (4) interposition of muscle and (5) repeated reduction.

In nonunion the condensation of callus takes place on the ends of the fragments with failure to bridge the defect with solid bone. The callus

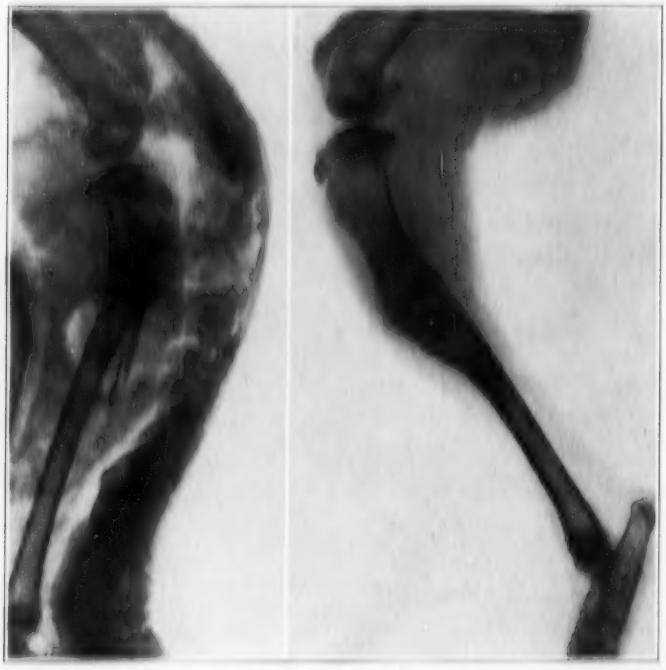


Fig. 3.—Solid union of bone at the five week stage in the control series.

Fig. 4.—The cycle of bone repair.

on the proximal fragment, usually in excess of that on the distal end, results in the formation of a nodular prominence on the proximal fragment with a cavity into which the distal fragment articulates. On the other hand, there may be no reaction of the bone to form callus, with resulting atrophy of the fragments.

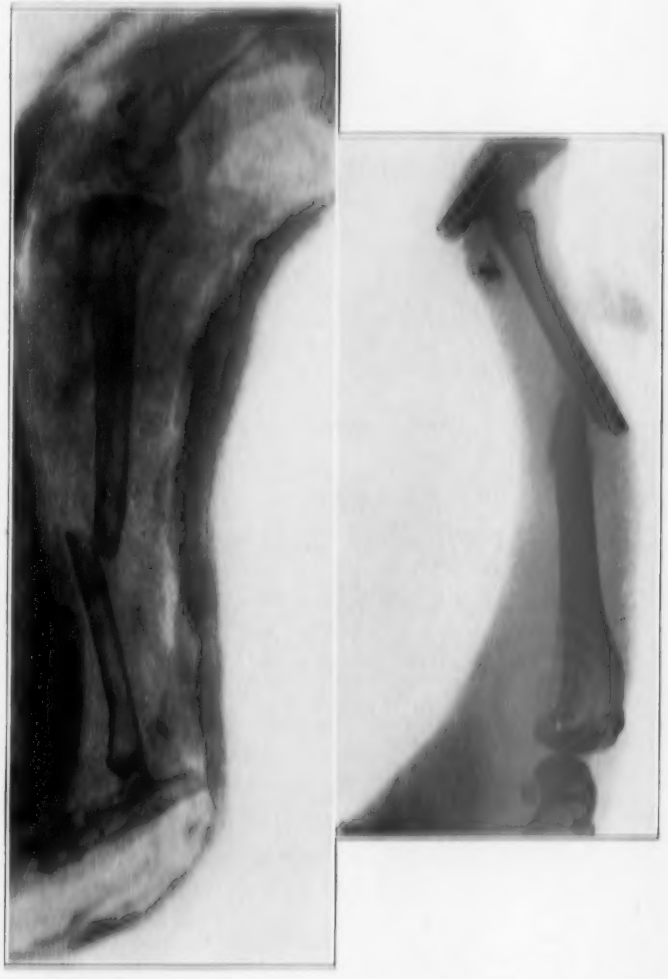


Fig. 5.—Scanty callus formation at the three week stage in the series given injections of trypsin.

The delayed union of bone may be due either to mechanical or to chemical causes. Obviously a variety of conditions may prevent union. The fragments may not be in apposition. Fixation or reduction may be inadequate. Frequently the process is actually interfered with by repeated examinations, and finally there may be actual injury to the

Fig. 6.—Slight union of bone at the five week stage in the series given injections of trypsin.

Fig. 7.—Abundant callus formation at the three week stage in the series given injections of tissue fibrinogen.

local blood supply, preventing the continuous availability of the constituents of the blood necessary for repair.

Local chemical conditions may be productive of delayed union. The injury to tissue at the site of fracture results in hemorrhage. Decomposition of the hematoma yields amino-acid which decalcifies the ends of the bone (Henderson). The blood phosphates are made available for the formation of bone by a hydrolyzing enzyme present

Fig. 8.—Solid union of bone at the five week stage in the series given injections of tissue fibrinogen.

in the ossifying cartilage (Robinson). A marked increase in the local hydrogen ion concentration tends to decrease the effective activity of the enzymes.

Constitutional treatment for delayed and ununited fractures is of no avail once nonunion is imminent. The problem is local, confined to the site of fracture. Attempts to increase the calcium and phosphorus concentrations of the blood by antirachitic measures have failed to

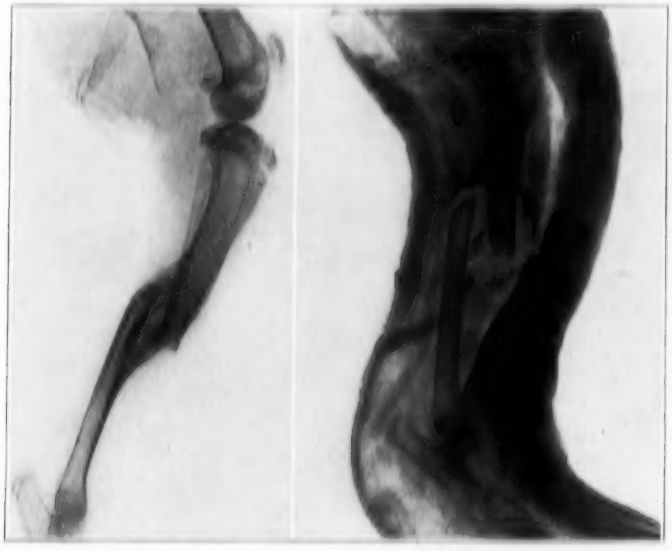


Fig. 9.—Moderate callus formation at the three week stage in the series fed on a diet high in protein.

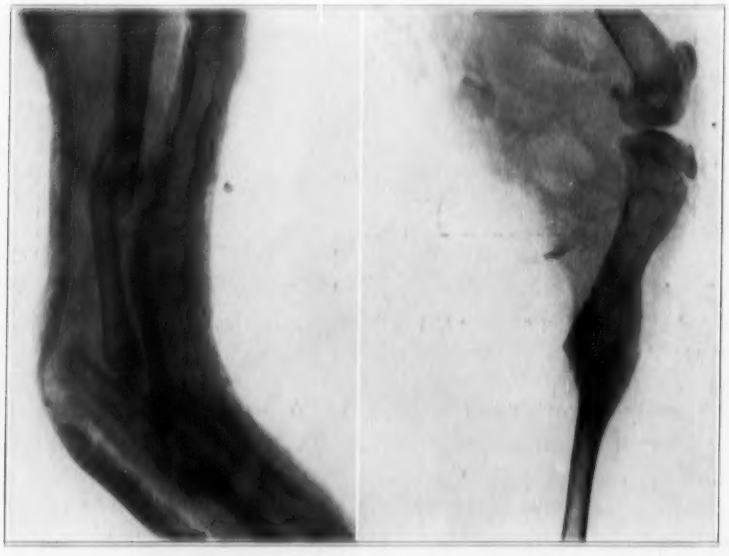


Fig. 10.—Abundant callus formation but incomplete union of bone at the five week stage in the series fed on a diet high in protein.

show any effect on the local condition. The stimulation of callus formation has been attempted by Bier's hyperemia maceration of the fragments under anesthesia by the injection into the point of fracture of blood, iodine, osmic acid, calcium salts and phosphates, and finally, by the functional use of the fractured extremity by surgical fixation or by the grafting of bone.

EXPERIMENTAL PROCEDURE

Three groups of rabbits in two separate sets of experiments were studied for the degree and rate of callus formation and calcification. Each rabbit was anesthetized with ether, blood was taken from the heart for chemical analyses, and

TABLE 3.—*Determinations of the Blood from the Time of Fracture to the Time of Union*

Third Experimental Series	Rabbit	Calcium	Phosphorus	Fibrin	Albumin	Globulin
April 11						
Trypsin group	1	14.5	6.61	0.379	4.43	3.34
	2	13.2	5.90	0.465	4.34	1.78
	5	14.8	6.37	0.253	4.21	1.41
	6	13.8	7.40	0.512	4.70	1.18
Fibrinogen group	7	14.4	7.00	0.288	4.34	0.57
	8	9.8	9.52	0.398	4.99	1.66
	9	8.0	qns.	0.660	4.83	2.59
	10	14.2	4.31	0.425	4.54	2.21
May 2						
Trypsin group	1	12.8	5.37	0.210	4.50	2.87
	2	13.8	5.76	0.208	4.47	1.70
	5	15.2	4.16	0.277	5.47	2.87
	6	14.8	5.51	0.221	4.21	2.31
Fibrinogen group	7	14.4	5.75	0.487	4.70	2.12
	9	14.4	5.93	0.618	5.40	3.00
	10	14.4	5.77	0.575	4.05	2.41
May 13						
Trypsin group	1	14.1	4.00	0.305	5.02	3.07
	2	13.8	4.50	0.221	4.17	2.72
	5	16.8	3.80	0.229	qns.	....
Fibrinogen group	9	16.0	3.75	0.465	4.15	2.46
	10	14.6	3.84	0.508	3.90	2.34

the tibia was fractured in midshaft. The fracture was immediately put into a plaster of paris cast, and as soon as this had hardened sufficiently, a fenestration was made to allow the introduction of the solution used. These preparations were introduced aseptically through the fenestration directly into the site of fracture. Some of the animals were maintained on the regular diet of hay, oats and leafy greens and the others were put on a special diet. The first group of animals was given an injection of 5 cc. of a 1 per cent solution of trypsin buffered in the following solution, p_H 7.4, consisting of 100 cc. each of sodium bicarbonate, 0.03 per cent; sodium chloride, tenth normal; magnesium sulphate, 0.0016 per cent, and potassium phosphate, 0.009 per cent at 37 C.

The injections were given at from twenty-four to thirty-six hour intervals; a long needle was introduced about an inch above the fractured site in healthy tissue, to preclude as far as possible the danger of infection. The second group of rabbits was treated in exactly the same method with the exception that an extract of tissue (fibrinogen) was substituted for the trypsin. One cubic centimeter of the sterile solution was injected into the hematoma immediately on

fracture. The third group constituted the control. These animals were subjected to the same treatment except that no solutions were injected into the site of fracture. The animals were watched carefully for evidence of vascular disturbance which might arise from too snugly fitting plaster casts; when this occurred, new casts were immediately applied. Roentgenograms were made of all of the animals each week to furnish a basis of comparison in the amount of callus thrown down. Specimens were removed from the animals killed at two and four week intervals. These were decalcified in toto in a 5 per cent solution nitric acid. Longitudinal sections were then made with a sharp blade for photographs and measurements of the callus. Microscopic sections were finally made from the center of the callus.

COMMENT

Experimentally induced fractures in animals revealed that, all other conditions remaining constant, the amount of available fibrous tissue is directly proportional to the degree and rate of calcification. The dissolution of the fibrous tissue normally formed following fracture, by means of an alkaline trypsin solution, diminished both the quantity and the rate of the formation of bone during the course of bone repair. On the other hand, the local injection, at the site of the fracture, of tissue fibrinogen which in itself contributed to the available content of and simultaneously stimulated the production of fibrous tissue, increased both the amount and the rate of the formation of bone. Attempts to alter the local production of fibrous tissue by means of a diet high in protein were ineffective in a comparison with results obtained by controls. Histologic studies revealed similar results. This study indicates that the mechanism of bone repair may be altered by the local introduction of substances involved in the process, and that it may vary strikingly in comparison with the indefinite results obtained by attempted systemic therapy.

Bone repair involves: (1) the approximation of the fractured ends; (2) their initial union with the network of fibrous tissue, and (3) the transformation of this fibrous network by solid calcium salts. Obviously any interposition of muscle or fascia between the fractured ends of bone will prevent the formation of the fibrous network. Local alterations in tissue may diminish the available production of fibrous tissue and hence result in a fibrous network inadequate to span the fractured ends. Finally any injury to the circulation will decrease the available supply of constituents in the blood necessary for the formation of bone tissue.

The trauma that causes the fracture simultaneously produces hemorrhage. The blood enmeshed in the fractured ends forms the clot of fibrin. Injury to the periosteum favors the additional formation of fibrous tissue in this network. There is a definite relation between the mechanism of blood coagulation and this subsequent stage of calcifica-

tion. Freshly formed fibrin has a greater capacity for the adsorption of calcium salts than has old fibrin, hence the more fibrin or fibrous tissue available, the more rapid will be the bond of union between the two fractured ends. The initial supply of calcium salts available for adsorption by fibrinogen is obtained by the local formation of amino-acid, which dissolves at least 20 per cent of the exposed ends of the bone. The subsequent and continuous supply of calcium salts is obtained from the blood. The spontaneous healing of fractures thus depends on the local hemorrhage induced by trauma to the tissue. There is no providential protection of the unity of the skeletal structure; unless the conditions are favorable, healing will not take place.

Chemical determination of the constituents of the blood involved in the process of calcification revealed certain alterations in the content according to the local conditions of the fracture and its treatment. The control series of animals showed that the normal course of the repair of fractures involves an increase in the calcium level of the blood with a decrease in the phosphorus content. The bone repair, therefore, appears to be a process of phosphorization rather than of calcification. The injection of tissue fibrinogen at the site of the fracture tended to increase the blood calcium with a simultaneous decrease of the blood phosphate to a level somewhat greater than that observed in the control animals. This difference in the effect produced in the blood by the introduction of tissue fibrinogen is explicable on the basis of the relative rates of bone repair. It has been repeatedly shown that the protein content of the blood is related to the total injection of calcium. Half of the protein concentration is bound to blood proteins as calcium proteinate. Fluctuations of the blood calcium with variations in the total protein of the blood have been observed in patients with nephritis and other diseases in which the protein metabolism is altered. A diet high in protein favors an elevated level of blood calcium, particularly if it is below normal. The animals on the diet high in protein maintained a higher level of calcium than the control animals, but all were well within the normal range. Protein in the form of tissue fibrinogen injected locally showed a similar trend. Diminution of other constituents of the blood involved directly or indirectly in the process of calcification, revealed no change when the treatment of experimentally induced fractures was altered.

CONCLUSIONS

1. The relation between callus formation and the amount and rate of calcification was studied in rabbits with experimentally induced fractures.

2. The greater the local formation of fibrous tissue, the greater was the amount and degree of calcification, all other conditions remaining the same.

3. The blood calcium tends to be higher and the phosphate lower in the course of normal bone repair, and the more rapid the rate of calcification the more marked is this alteration in the calcium and phosphate content of the blood.

4. Injection of an alkaline solution of trypsin, at the site of fracture to produce fibrous dissolution, markedly retarded the union of bones in comparison with that in the control series.

5. Injection of a solution of tissue fibrinogen in animals at the site of fracture, to stimulate increased callus formation, markedly accelerated the union of bones in comparison with that in the control series.

6. The maintenance of animals with experimentally induced fractures on a diet high in protein, to increase the blood-clotting factors, produced no local effect in bone repair as compared with the control series.

7. Ossification is a local transformation of fibrous tissue into bone, the constituents of which are derived from the blood. Bone repair is a local rather than a systemic process, and union may therefore be induced or accelerated by local therapeutic measures.

FACTORS INVOLVED IN COMBATING THE "HUNGER STRIKE" IN CHILDREN *

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AND
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SAN FRANCISCO

In seeking further light on the so-called "hunger strike" commonly encountered in the practice of pediatrics, a detailed study of 110 children complaining of anorexia was attempted to determine what characteristics they shared in common.

Combining Draper's [1] and Franzen's [2] systems, measurements of the body were made to classify the children according to the type of body, and to obtain a measure of their nutritional status. Basal metabolism tests were made at intervals of three months when possible. Examinations of the blood, urine and stools and intracutaneous tuberculin tests were made; roentgenograms of the chest were obtained after all positive reactions. Analyses were made of the usual diets of these children for a period of three days to determine the caloric intake and the proportion of the food elements habitually consumed. Special diets for individuals were worked out correcting the dietary errors that appeared on analysis of the three day diets.

The main complaint of anorexia presented by the 110 children was accompanied by constipation in 46 cases and by indigestion, abdominal pain or vomiting in 18 cases; 36 suffered from sties, boils and frequent infections; 62 were underweight, and 41 of these were described as overactive or highstrung, easily fatigued and irritable.

Measurements of girth and diameter of the trunk, correlated with stature, weight and age, established the fact that in this series the children who habitually did not eat had small and delicate bony frameworks, as compared with an equal number of other children of the same age and sex.

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* Submitted for publication, Aug. 12, 1930.

1. Draper, George: Disease and the Man, New York, The Macmillan Company, 1930.

2. Franzen, Raymond: Physical Measurements of Growth and Nutrition, New York, American Child Health Association, 1929.

We designate the types of build as linear, intermediate and lateral, using Stockard's [3] terminology. The measurements used for comparison were:

Circumference of the neck
Circumference of the chest at the nipple line
Circumference of the chest at the costal margin
Circumference of the abdomen at the level of the umbilicus
Circumference of the hips at the crest
Circumference of the upper arm at the middle of the biceps
Circumference of the calf at the greatest girth
Anteroposterior diameter of the chest at the level of the third rib
Lateral diameter of the chest at the axilla
Biacromial diameter
Bi-iliac diameter

Heights and weights were compared with the Woodbury or Baldwin height, weight and age tables. Every child whom we classified as of the linear type was from 0 to 10 per cent taller than the average for that age, and from 7 to 30 per cent under the average weight assigned in the table for that height and age. Every child whom we classified as of the lateral type was as tall or taller than the average for that age and from 10 to 66 per cent heavier than the average weight assigned in the table for that height and age. Children between these classifications we considered of the intermediate type.

In this series, anorexia had a high correlation with the linear type (82 per cent), and obstinate constipation had a high correlation with poor nutrition in that type. Nutrition was judged on a basis of the kind and amount of muscle and subcutaneous tissue measured by Franzen's [2] method. Girth measurements of the costal margin of the chest, the abdomen at the level of the umbilicus and the hips at the crest revealed hour-glass-shaped trunks in the poorly nourished linear type, and barrel-shaped trunks in the overweight lateral types.

A large proportion of this series were poorly nourished children, some of whom had not gained weight for periods of from three months to one and one-half years. Fatigue and irritability were characteristic of the most poorly nourished, and poor muscle tone was noted.

Extremely high rates of basal metabolism accompany and possibly explain the nervous type of overactivity which results in this fatigue and irritability. It seems easy, therefore, to explain the reason for the psychologic problems so often presented by this group. Psychologic examinations of a number of this group indicated intelligence higher than the average.

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3. Stockard, C. R.: Constitution and Type in Relation to Disease, Medicine 5:105, 1926.

TABLE 1.—*Measurements Obtained in Boys*

	A. Group Aged 3 Years		
	Linear Type: Poor Nutrition (George)	Linear Type: Fair Nutrition (Frank)	Lateral Type (Henry)
Girth			
Costal	49 cm.	51 cm.	61 cm.
At umbilicus	47 cm. (hour-glass)	49 cm.	64 cm. (barrel)
At hips	48 cm.	48 cm.	62 cm.
Chest diameter			
Anteroposterior	12.5 cm.	14 cm.	14 cm.
Lateral	15 cm.	16 cm.	18 cm.
Bi-iliac	15.5 cm.	16 cm.	17 cm.
Height	37 in. (93.9 cm.)	37.5 in. (95.2 cm.)	41.5 in. (104.7 cm.)
Weight	29 lb. (13.2 Kg.)	30 lb. (13.6 Kg.)	49.5 lb. (22.4 Kg.)
Average height for age and sex	36.5 in. (92.7 cm.)	36.5 in. (92.7 cm.)	36.5 in. (92.7 cm.)
Average weight for height and age	32 lb. (14.5 Kg.)	32.5 lb. (14.7 Kg.)	38 lb. (17.2 Kg.)

	B. Group Aged 7½ Years		
	Linear Type: Poor Nutrition (Robert)	Linear Type: Fair Nutrition (Donald)	Lateral Type (Allen)
Girth			
Costal	59 cm.	61 cm.	63 cm.
At umbilicus	57 cm. (hour-glass)	58 cm.	64 cm. (barrel)
At hips	59 cm.	54 cm.	63 cm.
Chest diameter			
Anteroposterior	14 cm.	16 cm.	17 cm.
Lateral	19 cm.	19 cm.	19 cm.
Bi-iliac	20 cm.	18 cm.	21 cm.
Height	49.5 in. (125.7 cm.)	49.5 in. (125.7 cm.)	51.5 in. (130.7 cm.)
Weight	48.5 lb. (22 Kg.)	53 lb. (24 Kg.)	67 lb. (30.4 Kg.)
Average height for age and sex	49 in. (124.5 cm.)	49 in. (124.5 cm.)	49 in. (124.5 cm.)
Average weight for height and age	56.5 lb. (25.6 Kg.)	56.5 lb. (25.6 Kg.)	62 lb. (28.1 Kg.)

TABLE 2.—*Measurements Obtained in Girls*

	A. Group Aged 9 Years		
	Linear Type: Poor Nutrition (Margaret)	Linear Type: Fair Nutrition (Anne)	Lateral Type (Helen)
Girth			
Costal	62 cm.	66 cm.	62 cm.
At umbilicus	54 cm. (hour-glass)	58 cm.	68 cm. (barrel)
At hips	63 cm.	60 cm.	70 cm.
Chest diameter			
Anteroposterior	13.5 cm.	15 cm.	17 cm.
Lateral	20 cm.	18 cm.	18 cm.
Bi-iliac	22 cm.	20 cm.	21 cm.
Height	56 in. (142.2 cm.)	60 in. (127 cm.)	59 in. (127 cm.)
Weight	61 lb. (27.7 Kg.)	54 lb. (24.5 Kg.)	75 lb. (34 Kg.)
Average height for age and sex	50 in. (127 cm.)	50 in. (127 cm.)	50 in. (127 cm.)
Average weight for height and age	76 lb. (34.5 Kg.)	58 lb. (26.3 Kg.)	58 lb. (26.3 Kg.)

	B. Group Aged 12 Years		
	Linear Type: Poor Nutrition (Catherine)	Linear Type: Fair Nutrition (Mary)	Lateral Type (Annette)
Girth			
Costal	61 cm.	63 cm.	87 cm.
At umbilicus	55 cm. (hour-glass)	64 cm.	91 cm. (barrel)
At hips	61 cm.	67 cm.	99 cm.
Chest diameter			
Anteroposterior	19 cm.	15 cm.	19 cm.
Lateral	20 cm.	21 cm.	27 cm.
Bi-iliac	21 cm.	21 cm.	27.5 cm.
Height	58 in. (147.3 cm.)	59.5 in. (151.2 cm.)	56.5 in. (143.4 cm.)
Weight	58.5 lb. (26.5 Kg.)	80 lb. (36.3 Kg.)	130 lb. (59 Kg.)
Average height for age and sex	58 in. (147.3 cm.)	58 in. (147.3 cm.)	58 in. (147.3 cm.)
Average weight for height and age	86 lb. (39 Kg.)	92 lb. (41.7 Kg.)	80 lb. (36.3 Kg.)

Enforcing abundant rest is effective in overcoming problems of behavior as well as important in the treatment for anorexia. Our regimen of rest provided for breakfast in bed, getting up at 10 a. m., being out of doors in the sunshine if possible until noon, a nap from 1 to 3 p. m. and going to bed at 7 p. m. In a few cases the children were put to bed for a period of from ten days to two weeks in the beginning of the treatment.

Functional versus organic types of anorexia have been discussed by Bartlett,[4] Schlutz,[5] Carlson[6] and others. The organic form, as described by Bartlett, occurs in a person whose nutrition suffers because of chronic foci of infection, most often located about the head. He named

Fig. 1 (table 1).—George, linear type, showing delicate framework as a result of poor nutrition.

septic tonsils and adenoids, acute infections, tuberculosis, pyelitis and dental caries. That all foci of infection must be removed before a child is free to gain is conceded. Constitutional factors are at work in the hunger strike as evidenced by the fact that the type of child presenting the complaint of anorexia belongs overwhelmingly to the linear group.

4. Bartlett, W. M.: Analysis of Anorexia, Am. J. Dis. Child. **35**:26 (Jan.) 1928.

5. Schlutz, F. W.: The Problem of Chronic Anorexia in Childhood, J. A. M. A. **94**:73 (Jan. 11) 1930.

6. Carlson, A. J.: The Control of Hunger in Health and Disease, Chicago, University of Chicago Press, 1916.

Fig. 2 (table 1).—Frank, linear type, showing fair nutrition and greater height than average for the age.

Fig. 3 (table 1).—Henry, lateral type, illustrating barrel-shaped trunk in a child of linear type.

Davenport [7] noted that subjects of the linear type show susceptibility to the infections listed.

Deranged physiologic processes, explained by Sauer,[8] Hurwitz,[9] Carlson [6] and others as occurring in chronic anorexia, indicate that gastric atony delays the emptying time of the stomach and diminishes the secretion of gastric juice. The amounts of both free and combined hydrochloric acid are as low as half those found in normal children. Schlutz [5] and Rupp showed that asthenic children had a marked decrease in motility as regards both duration of activity and number of contractions occurring during the period of activity.

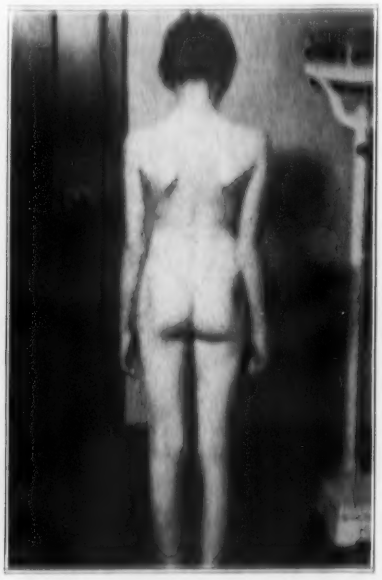

Fig. 4 (table 3).—Margaret, showing hour-glass-shaped trunk in child of linear type.

The deleterious effect on the appetite of a high proportion of fat in the diet has been well described by Aldrich,[10] who said that all foods rich in fat pass out of the stomach slowly, and that "the stomach tends to be low and to empty slowly in all patients with poor muscular development, especially in those of slender type." Poor appetite in itself causes

7. Davenport, C. B.: Body Build and Its Inheritance, Washington, D. C., Carnegie Institution of Washington, 1924.

8. Sauer, L. W.; Minsk, L. D., and Alexander, W. G.: Gastric Findings in Children with Anorexia, J. A. M. A. **79**:184 (July 15) 1922.

9. Hurwitz: Deutsche med. Wchnschr. **46**:883, 1920.

10. Aldrich, C. A.: Cultivating a Child's Appetite, New York, The Macmillan Company, 1927.

a decrease in the secretion of gastric juice, and therefore may delay the digestion and emptying time of the stomach. Alvarez [11] stated that many cases of constipation are due purely to the fact that the stomach does not empty rapidly enough. It seems reasonable that children of the linear type, who possess less abdominal musculature than children of the lateral type and whose small, perpendicularly placed stomachs exhibit a tendency to slow emptying, should be given diets low in fat content as a routine measure.

Mothers of children who complained of anorexia were instructed to keep a record of the kind and amount of food actually eaten by the

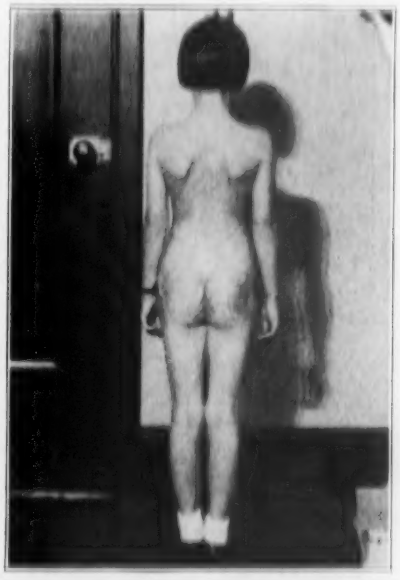

Fig. 5 (table 2).—Anne, linear type with fair nutrition.

children for three days. Diets of an equal number of other children of the same ages who ate well were examined for comparison.

Analysis of the three day diets revealed that mothers whose children were of the linear type were much more likely than others to offer diets containing high proportions of fat in their efforts to force these children to attain the average weight for height and age. The necessity for drinking a quart of milk a day seems to have been an obsession with these mothers.

In our analyses, we found the fat content as high as 51.6 per cent, which far exceeds the proportion allowed by authorities on diet. We

11. Hosoi, K.; Alvarez, W. C., and Mann, F. C.: Intestinal Absorption, Arch. Int. Med. **41**:112 (Jan.) 1928. Alvarez, W. C.: Personal communication to the authors.

Fig. 6 (table 2).—Helen, lateral type, 17 pounds overweight.

Fig. 7 (table 2).—Catherine, poorly nourished child of linear type.

have followed the work of McLean and Fales,[12] Emerson [13] and Holt [14] in building our diets. We give daily menus for seven days with substitute lists and recipes, planned for each year from 2 to 8 years of age and for each three years from 8 to 16 years.

Diets that we call normal allow approximately 15 per cent protein, two thirds of which is animal; from 50 to 60 per cent carbohydrate, one-half sugar and one-half starch, and from 25 to 35 per cent fat. From thirty-five to forty calories per pound of body weight are provided. Proper allowance is made for supplying vitamins, minerals, alkaline salts and fruit acids necessary for growth and development. While

Fig. 8 (table 2).—Mary, linear type, showing fair nutrition.

amounts are indicated to cover caloric needs judged by average weights at different ages, the mothers are always instructed to let the appetite of the child determine the amounts of food taken, and never to force food because of varying metabolic requirements.

McLean and Fales [12] have pointed out that "the thin underweight child requires considerably more food than the normal allowance, (1) because his basal metabolism is much higher per unit than that of a

12. McLean, S., and Fales, H.: Scientific Nutrition in Infancy and Childhood, Philadelphia, Lea & Febiger, 1926.

13. Emerson, W. R. P.: Nutrition and Growth in Children, New York, D. Appleton & Company, 1922.

14. Holt, L. E.: Care and Feeding of Children, New York, D. Appleton & Company, 1924.

child of average weight for his height, and (2) because body building should proceed at more than the usual rate in order that the child may reach the normal standard. Conversely, the fat child requires less than the normal because of lowered basal metabolism, and because of diminished needs for body building." Emerson [13] cited the case of identical twins who remained the same in height and weight although one regularly ate a great deal more heartily than the other.

Our experience leads us to agree with Garland,[15] Aldrich [16] and others that milk should be eliminated from the diet or be greatly reduced in amount, as a first step in dealing with anorexia. We have substituted

Fig. 9 (table 2).—Annette, lateral type, 50 pounds overweight.

a quart of fruit juices for the usually accepted quart of milk. All the citrus fruits may be used to advantage. Orange juice makes a good basis, and juice of berries and fresh or canned fruits may be added to make a pleasing variety of fruit punches which usually are taken eagerly by children. Citrus fruits are rich in vitamin C and also contain vitamins A and B. As vitamin C is important for efficient utilization of calcium and as the appetite-stimulating property of vitamin B has been demonstrated, the citrus fruits are especially indicated for the type of child described. Lemon and grapefruit juices are effective in combat-

15. Garland, J.: The Hunger Strike in Infants, New England J. Med. **200**: 1135 (May 30) 1929.

ing achlorhydria and so assume importance in the diet of children of the linear type.

Most of our cases (twenty-seven out of forty-six) of obstinate constipation occurred between the ages of 2 and 6 years and in the poorly nourished (by measurement) linear type.

A series of gastro-intestinal examinations on a number of children showed from moderate to severe distention of the colon. These cases of distention of the colon, combined with a weak abdominal musculature, respond best to a low residue, low fat and high vitamin diet. Our low

TABLE 3.—*Observations on Children Given a Diet of Low Residue, Low Fat and High Vitamin Content*

Name	Age, Years	Complaints	Duration of Anorexia	Body Type	Analysis of 3 Day Diet*	Duration of Special Diet	Results of Diet and Regimen
Margaret	5	Poor appetite, constipated, underweight, digestive troubles, difficult feeding problem as a baby	3-4 yr.	Linear	P 15.7% F 36.9% C 47.9% Cal. 1,681	5 mo.	Appetite "wonderful"; general improvement; gained 3 lb. in 2½ mo.; bowels regular
Charles	5	Very poor appetite, constipated; underweight, cryptic tonsils	2 yr.	Linear	P 19.2% F 41.8% C 39.0% Cal. 1,146	4 mo.	Appetite good; bowels regular; general condition improved
Barbara	3	Poor appetite, constipated, highstrung, asthma	3-4 mo.	Linear	P 14.4% F 44.5% C 41.1% Cal. 1,450	3 mo.	Good appetite; bowels regular
Peter	8	Obstinate constipation, no interest in food, fatigue	From birth	Linear	P 16.3% F 41.7% C 42.0% Cal. 1,756	3 mo.	Eating well; "Peter is a different child—improved in every way"; daily stool
Beverley	4½	No appetite, constipated, abdominal pain, underweight, highstrung	Since infancy	Linear	P 13.6% F 30.3% C 56.1%	3 mo.	Good appetite; bowels regular; marked general improvement
Nina	8½	Poor appetite, very constipated, dilated colon, frequent colds	1 yr.	Intermediate	P 15.5% F 35.7% C 48.8% Cal. 1,425	5 mo.	Hungry; bowels improved; gaining

* P indicates protein; F, fat; C, carbohydrate, and Cal., calories.

residue diet provides from thirty-eight to forty calories per pound of body weight, a composition of from 16 to 18 per cent protein, from 18 to 21 per cent fat and from 58 to 63 per cent carbohydrate. No milk is given in this diet, fruit juices being substituted; all food is strained. Massage of the abdomen and special exercises for abdominal muscles are carried out both to increase the amount and tone of the muscles and to aid in reducing the colon.

In the present series oil retention enemas followed by colonic flushes with physiologic solution of sodium chloride in large amounts were given at weekly intervals in a few cases in which there were hard fecal masses.

Dr. Bargen at the Mayo Clinic attained good results in children with borderline dilatations of the colon with a diet of low residue content and frequent warm enemas of physiologic solution of sodium chloride. Dr. Alvarez [11] said that if the bowel is kept washed out, it tends to shrink and regain much of its functional capacity, and that a diet of high residue is bound to make matters worse.

Indigestion, vomiting or abdominal pain associated with poor appetite were encountered in older children, from 7 to 13 years of age.

TABLE 4.—*Observations on Children Given a Diet of Low Fat, Low Starch and High Vitamin Content*

Name	Age, Years	Complaints	Duration of Anorexia	Body Type	Analysis of 3 Day Diet*	Duration of Special Diet	Results of Diet and Regimen
Margaret	9½	Appetite poor, marked fatigue, many infections, 16 lb. underweight, indigestion	3-4 yr.	Linear	P 16.0% F 45.0% C 39.0% Cal. 1,795	5 mo.	Gained 22 lb. in 5 mo.; appetite very good; general condition much improved
Robert	8	Poor appetite, moderate constipation, underweight, fatigue, indigestion, hay-fever	2 yr.	Linear	P 12.8% F 37.0% C 49.3% Cal. 1,805	4 mo.	Appetite good; bowels regular; gained 4 lb. in 4 mo.; "peppy"
Cora	12	Poor appetite, underweight, fatigue, abdominal pain, restless sleeper	Never ate well	Linear	P 14.2% F 39.5% C 46.3% Cal. 2,775	3 mo.	Good appetite; gained 3 lb. in 3 mo.; sleeps quietly; feels better
Herbert	13	Poor appetite, abdominal pain, vertigo, overactive, fatigue, underweight	3-4 yr.	Linear	P 18.7% F 38.4% C 42.9% Cal. 2,095	4 mo.	Appetite improved; no abdominal pain or vertigo; gained 3 lb. in 6 wk.
Catherine	12	Poor appetite, constipation, fatigue, underweight, asthma, abdominal pain	3-4 yr.	Linear	P 13.8% F 51.6% C 34.6%	4 mo.	Appetite good; bowels regular; gained 13 lb. in 3 mo.; marked general improvement
Pat	7½	Poor appetite, vomiting, underweight, irritable	1 yr.	Linear	P 17.5% F 39.7% C 42.8% Cal. 2,000	3 mo.	Appetite splendid; no vomiting; gained 3½ lb. in 3 mo.

* P indicates protein; F, fat; C, carbohydrate, and Cal., calories.

After appendicitis had been ruled out as far as possible, these children were given diets of low fat, low starch and high vitamin content planned to cover caloric requirements.

A surprising number (thirteen of eighteen) of this group had been eating rich food. One of these patients had been on a diet of high carbohydrate content (74 per cent) by reason of the liberal addition of a widely advertised patent food to flavor everything she did not like.

SUMMARY

In the 110 cases of anorexia here reported, we have had good results after from six weeks to three months on diets of low residue, low fat

and high vitamin content, or on diets of low fat, low starch and high vitamin content combined with a regimen of rest and any special therapy indicated.

CONCLUSIONS

Body measurements established the fact that 82 per cent of 110 children complaining of anorexia had the linear type of build.

Obstinate constipation had a high correlation with poor nutrition in the linear type in this series.

Fatigue and irritability were characteristic of the most poorly nourished children.

High rates of basal metabolism accompany and possibly explain the nervous type of overactivity noted in many children of the linear type.

Diets high in fat content commonly fed to underweight children are contraindicated for subjects of the linear type.

Children of the linear type should be given diets with a low fat content.

The substitution of one quart of fruit juices for the one quart of milk a day usually prescribed has a stimulating effect on the appetite.

A diet of low residue successfully combats persistent constipation associated with mild distention of the colon.

CONGENITAL INTESTINAL ATRESIA *

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AND
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MINNEAPOLIS

Congenital atresia and stenosis of the intestine, exclusive of the pylorus, rectum and anal canal, is a relatively rare condition, occurring in about 1 of 20,000 infants. We have been able to find mention of more than 500 instances previously reported in the literature, though this number probably does not include all the recorded cases. In this paper we are submitting the report of 2 instances that came under our observation and 15 additional cases from the records of the department of pathology of the University of Minnesota.[1]

In the two cases that we observed, the nature of the condition present was correctly recognized, and both patients were operated on, with the unfortunate lethal ending that usually attends the condition. Many authorities regard atresia of the intestine as an irremediable condition with an invariably fatal outcome. A study of the literature, however, reveals that the infants in nine isolated reported instances survived operation. We should like to bring this encouraging information concerning an otherwise hopeless state before the medical profession in the hope that a ray of optimism may penetrate the cloud of pessimism that enshrouds the treatment for congenital atresia of the intestine.

REPORT OF CASES

CASE 1.—*History.*—J., a white boy, born on Feb. 4, 1929, was admitted to the University Hospital on February 7, with the history of persistent vomiting, which started twelve hours after a normal birth. The vomitus was brown and had a fecal odor. There had been no bowel movements or urination since birth. An enema had been given, with the return of a pasty stool.

Examination.—Examination showed a somnolent infant, with flushed skin and distended abdomen which was painful on palpation. The little finger inserted into the rectum met no obstruction. An enema was given and returned clear. Roentgen examination of the abdomen revealed the presence of gas in the small intestine; when the plate was made in the upright posture, fluid levels were visible (fig. 1*B*). Barium sulphate given by enema traversed the colon as far as the midtransverse colon, and barium given by mouth left the stomach and was visible in the upper reaches of the small intestine (fig. 1*C*). These roentgenograms were made during

* Submitted for publication, Sept. 12, 1930.

* From the Departments of Pediatrics and Surgery, University of Minnesota.

1. Dr. E. T. Bell, Professor of Pathology, furnished the case reports from his records.

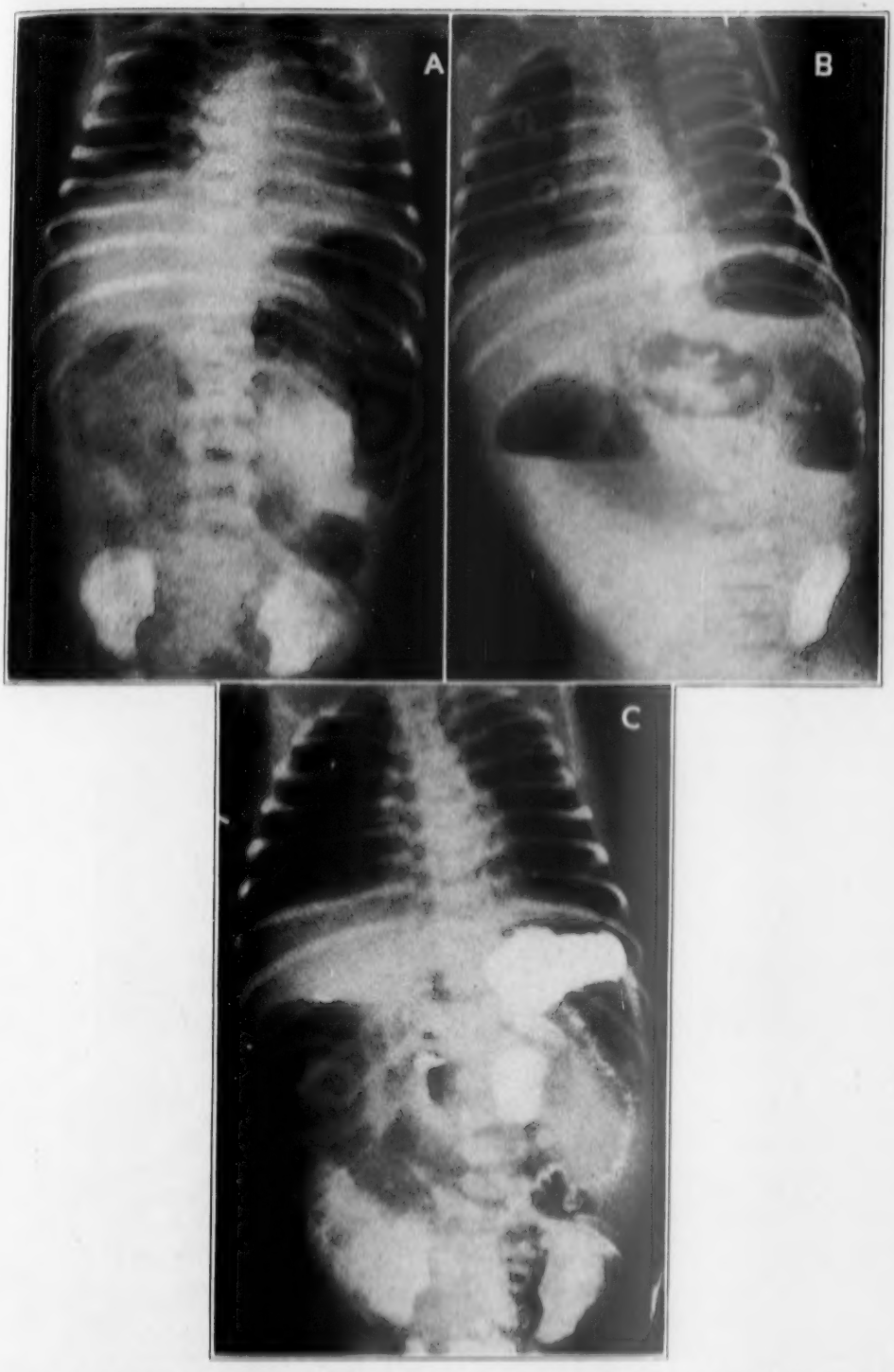
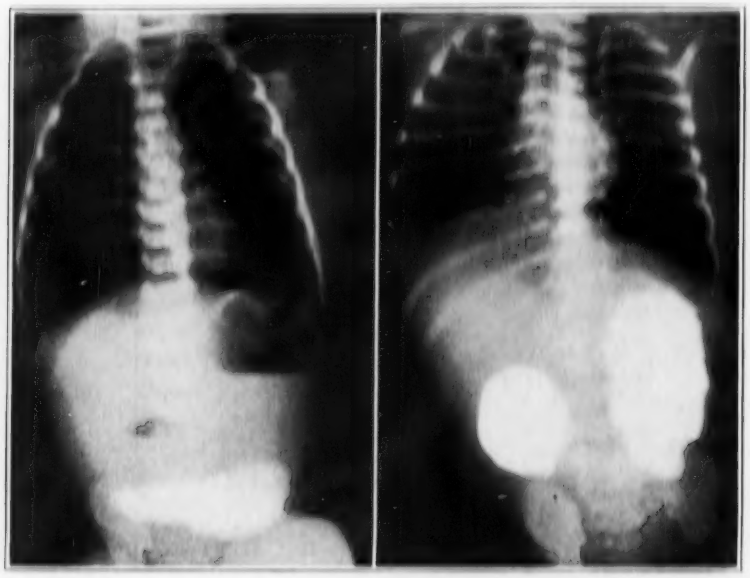


Fig. 1.—*A*, roentgenogram of abdomen in case 1 in supine position. Gaseous distention of the small intestine on the right is apparent. Gas is also present in the stomach and left side of colon. *B*, roentgenogram made in erect posture. "Fluid mirrors" are apparent. *C*, roentgenogram taken after oral and rectal instillation of barium sulphate. The barium has left the stomach, and the course of the pelvic, descending colon as far as the splenic flexure is easily traced. Contrast the tiny lumen of the colon with the loop of small intestine on the right, distended with gas. The administration of barium is not necessary to make the diagnosis, but it is a measure in atresia that necessitates no great delay and helps in part to establish the level of the atresia and to rule out duodenal and colonic atresia.

the hour in which preparation was being made for operation. The preoperative diagnosis was atresia of the small intestine.

Operation.—A physiologic solution of sodium chloride was given subcutaneously, and, under light ether anesthesia, the abdomen was explored (by O. H. W.). On opening the peritoneal cavity, several coils of distended, cyanotic intestine presented. The enormously distended ileum ended abruptly about 20 cm. from the ileocecal junction. The corresponding distal end of the intestine was also closed and was of small diameter. It appeared permeable, however, and the barium previously given by rectum having diffused into the transverse colon, this was thought to be the only atresic area, and a side-to-side anastomosis was effected between the two loops of the ileum. The anastomosis was made with considerable difficulty, owing to the disproportion in size between the two ileal loops. A 00



A B

Fig. 2.—*A*, roentgenogram of the patient in case 2 taken in erect posture. (The patient had been given barium before admission.) The enormous distention of the stomach is apparent. A large gaseous bubble is present in the fundus. The only other gas visible in the abdomen is a small shadow opposite the third lumbar vertebra. *B*, roentgenogram made in the erect posture after the administration of more barium. The abrupt termination of the first portion of the duodenum is apparent. The barium was largely recovered before operation by lavage of the stomach.

catgut suture was first employed, but when the needle and catgut were pulled through the dilated wall of the distended bowel, a puncture wound was left larger than the suture material occupied. Substitution of a fine silk proved much more satisfactory. Transfusion of blood into the superior longitudinal sinus immediately after the operation resulted in temporary improvement, but the infant died six hours later.

Autopsy.—Postmortem examination showed complete atresia as described, with anastomosis present. No other abnormalities were discovered.

CASE 2.—*History.*—A white girl, born on Feb. 10, 1930, was admitted to the University Hospital on February 16 at 11 a. m. with the history of vomiting. The birth was normal with the exception of hydramnios. The infant was too weak to nurse, and was fed breast milk by spoon. Regurgitation occurred within five minutes after every feeding for the first three days. After this time forceful vomiting occurred at intervals up to forty minutes after each feeding. The vomitus was not bile-stained. Normal, bile-colored stools were obtained at first, later the stools became progressively smaller. There were continued loss of weight and increasing weakness. On the day previous to hospitalization, the attending physician found complete retention of a barium meal in the stomach.

Examination.—Examination showed a very small, apathetic infant, weighing 2,200 Gm., and 45 cm. in length. Dehydration was evidenced by dry skin and lips, poor turgor, a depressed fontanel and elevation in temperature. No tumor

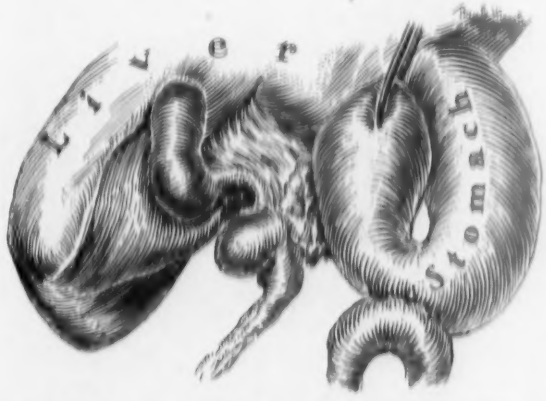


Fig. 3.—Drawing made from a specimen removed at autopsy in case 2. The abrupt interruption of the continuity of the gastro-intestinal canal at the points of juncture of the first and second portions of the duodenum is well shown. The common bile duct empties into the summit of the second portion. Pancreatic tissue was directly interposed between the two closed ends. The gastrojejunostomy is also shown.

or peristalsis was observed. Roentgen examination showed barium, given the previous day, still in the stomach; no barium had gotten into the small intestine. The stomach was markedly distended and contained a large accumulation of gas. Additional barium failed to leave the stomach (fig. 2*A*). The preoperative diagnosis was congenital atresia of the first portion of the duodenum.

Operation.—The infant was given 250 cc. of a physiologic solution of sodium chloride by hypodermoclysis twice during the day, and because of her poor condition, operation was deferred until 9 p. m. Under infiltration anesthesia of the abdominal wall with procaine hydrochloride, the peritoneal cavity was opened through an upper right rectus incision (by O. H. W.). Complete atresia of the duodenum 2 cm. from the pylorus was found. The stomach and proximal duodenum were enormously dilated; the entire intestine below the obstruction was collapsed.

It at first appeared that an anastomosis between the stomach or duodenum and the bowel below the atresia was not feasible because of the small caliber of the distal bowel. When, however, a short segment beyond the duodeno-jejunal angle was isolated between two, small, rubber covered clamps and inflated by injecting air with an hypodermic syringe, the bowel distended adequately to permit of easy anastomosis (fig. 7). Anterior gastro-enterostomy was performed. A one-layer, continuous, Connell suture of silk gave a satisfactory peritoneal inversion; a few interrupted sutures were placed to lend added security.

On completion of the operative procedure the patient seemed in good condition, and a transfusion of blood, which had been contemplated, was considered unneces-

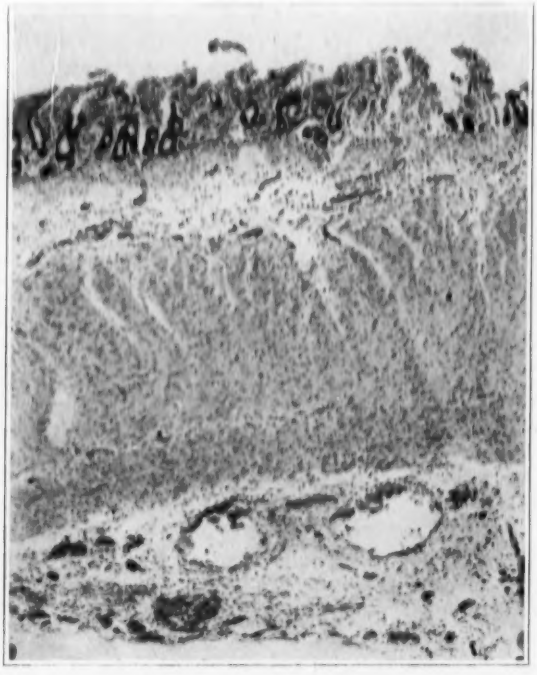


Fig. 4.—Section through the wall of the ileum immediately above the obstruction in case 1, showing marked hypertrophy of the musculature, particularly the inner layer.

sary. The infant was returned to the ward and 100 cc. of a physiologic solution of sodium chloride was administered subcutaneously. Her condition was satisfactory until 3 a. m., when irregular respiration and weak pulse developed, followed shortly by death.

Autopsy.—Examination showed a dilated stomach and complete atresia of the duodenum, as has been described. Numerous blood clots in the peritoneal cavity and the sheath of the rectus indicated hemorrhage as the chief cause of death, although there was no obvious source for the bleeding. An annular pancreas separating the proximal and distal segments of the duodenum apparently had been an etiologic factor in the failure to maintain the continuity of the bowel (fig. 3). The common bile duct emptied into the most proximal portion of the duodenum

beyond the atresia, in agreement with the presence of bile-tinged meconium in the lower part of the bowel, as observed in the stools and enema before operation.

The anastomosis, which was an anterior gastro-enterostomy, was satisfactory, and a catheter introduced into the distal loop leading away from the stoma demonstrated that fluid and air could be forcibly injected under pressure without leakage. In order to introduce the catheter into the lumen of the bowel, the intestine was first distended with a hypodermic syringe, as had previously been done at operation.

The notes on the 15 cases that follow were obtained from the records of 15,000 autopsies in the possession of the department of pathology.

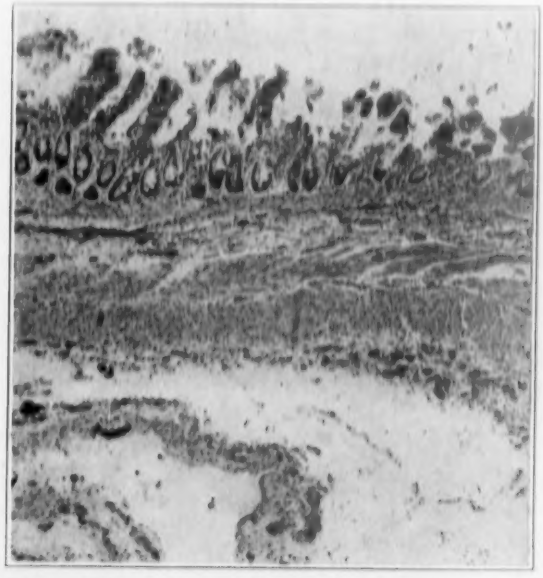


Fig. 5.—Section through the intestinal wall immediately below the obstruction in case 1, showing a relatively thin muscular layer as compared with that in figure 1.

Case 3.—C., a white boy, died on Jan. 16, 1912, at the age of 4 days. The clinical diagnosis was intestinal atresia. A single passage of a small amount of fecal material from the rectum was described; the abdomen was greatly distended.

Autopsy observations were: The length of the body was 46 cm. The peritoneal cavity contained bloody fluid, and numerous small hemorrhagic areas ascribed to sepsis were noted throughout the intestinal tract and other internal organs. The stomach and the greater portion of the small intestine were dilated, the diameter of the ileum being from 3 to 4 cm. in places; 23 cm. above the ileocecal valve, in the region of Meckel's diverticulum, there was a complete constriction. Below this point, the bowel was collapsed.

Case 4.—H. died on April 8, 1917, at the age of 3 days. Birth was normal, except for the presence of hydramnios. The weight at birth was 3,000 Gm. Unusual distention of the abdomen was noted immediately, and five hours after

birth the infant vomited a dark brown fluid. Later, following the insertion of a suppository, clear mucus was passed from the rectum. Vomiting continued, and on the following day, operation showed enormous distention of the proximal half of the small intestine, with a hard, cordlike condition of the distal 90 cm. This portion of the ileum, with the cecum and appendix, was resected; the ascending colon was ligated, and the end of the ileum brought to the surface as an enterostomy. Death occurred 73 hours after birth.

Autopsy showed the free end of the ileum to be gangrenous. The upper 45 cm. of the intestine was dilated, being 4 cm. in diameter. The jejunal portion was hemorrhagic and contained thick meconium. The resected portion of the intestine had the appearance of a rosary, with diameters varying from 0.5 to 1.5 cm. The

Fig. 6.—Section through the fibrous cord connecting the segments of the bowel in case 1. Careful examination reveals no evidence of normal intestinal structure or elements in this cord, which is composed entirely of fibrous connective tissue.

ileocecal junction was indistinct, represented by fibrous bands encircling the terminal ileum. A gray caseous material was present in the colon.

Case 5.—C., a white girl, was delivered on Aug. 1, 1920, at Eitel Hospital. An obstruction was evident from the first, for the infant was unable to retain either food or water and grew gradually worse until death on August 5. Roentgen examination showed a distended stomach, which almost filled the abdominal cavity, and complete pyloric occlusion.

At autopsy the stomach was found to be dilated to a marked degree and exhibited hourglass-like constriction, which was found to be represented by the dilated stomach and duodenum on either side of the pylorus. The lower end of the duodenum ended in a blind sac, connected with the distal bowel by a cordlike structure 1 mm. in diameter and 1 cm. in length. The bowel below the constriction was collapsed, but distended normally when filled with water. Bile-stained feces were present below the obstruction.

CASE 6.—B., a white girl, died on Jan. 28, 1921, at the age of 24 hours. Labor was difficult, of forty-eight hours' duration and was terminated by delivery with low forceps. A large amount of meconium was noted. Vomiting began shortly after birth and continued until death. Gastric lavage and rectal enemas obtained no result.

At autopsy the abdomen was distended. Exposure of the abdominal contents showed that the distention was due to the small intestine; the large bowel was collapsed. Numerous adhesions were present between the intestines and the right abdominal wall, some too strong to be loosened without tearing the bowel. Immediately below the gallbladder was a closed loop of bowel, in the form of two connected, cystlike structures, closely adherent and containing meconium. Three centimeters below the ileocecal valve, the dilated intestine graded off sharply into the collapsed portion, with complete closure of the lumen, but with an uninterrupted mesentery. Brown meconium was present in the stomach and small intestine; thick whitish material was present in the colon.

CASE 7.—M., a white boy, was delivered on May 28, 1921, at the Minneapolis General Hospital. The infant was breast-fed; vomiting and diarrhea occurred. The infant was discharged at the end of one week, but was readmitted on June 11, at which time roentgen examination showed a dilated and active stomach, with 90 per cent retention. The diagnosis was congenital pyloric stenosis. At operation, the surgeon found a folding and kinking of the second portion of the duodenum, apparently due to adhesive bands. These were released, but the infant died following the operation.

At autopsy the stomach and first portion of the duodenum were found to be dilated; the pylorus was normal. A narrowing of the duodenum was found at the junction of the first and second portions, with scar tissue from the operation. This portion of the duodenum was tightly adherent to the posterior wall, producing a stenosis. The remainder of the intestinal tract was normal.

CASE 8.—W., a white girl, was born on July 8, 1922, with a birth weight of 3,200 Gm. Birth and course for twenty-four hours were normal; then a hemorrhage from the umbilical cord and emesis of a dark brown fluid occurred. Vomiting continued and examination demonstrated delayed coagulation of the blood, leading to a diagnosis of hemorrhagic disease. Whole blood was given intramuscularly, but the infant died on July 12.

At autopsy the duodenum was found to be greatly distended, measuring 4 by 5 cm. The stomach was normal, and the pylorus hypertrophied. The contents of the duodenum could be expressed into the stomach, but not into the third portion of the duodenum, which, with the distal portion of the duodenum and the upper jejunum, was closely adherent to the posterior wall and surrounded by numerous fibrous bands extending up beneath the liver. The gastric and duodenal contents were chocolate colored and of mucoid consistency.

CASE 9.—C., a white girl, was delivered on May 28, 1924, at the Maternity Hospital, weighing 2,300 Gm. It was fed breast milk every four hours, but regurgitated each feeding immediately. Thirty-six hours after birth, a brownish fluid was vomited almost continuously. Both cyanosis and jaundice were noted. Meconium was passed. Death occurred forty-eight hours after birth.

At autopsy the stomach and first portion of the duodenum were found to be dilated; a constriction was present just below the papilla of Vater, completely obstructing the lumen. The head of the pancreas enveloped the duodenum at the point of obstruction. The gastric wall was apparently hypertrophied.

Case 10.—V., a white boy, was stillborn two weeks prematurely on Jan. 22, 1925, at the Eitel Hospital. Both parents gave negative Wassermann reactions. The heart was beating after delivery, but respiration could not be established.

At autopsy the weight was 2,110 Gm. Adactylism of the right hand, tetradactylism of the right foot and left talipes varus were noted. When the abdomen was opened it presented a dilated loop of intestine, comprising the duodenum and part of the jejunum, ending in a blind pouch. The mesentery showed partial division at the point of atresia; the bowel was completely interrupted. The entire tract below the atresia was collapsed. Cerebral hemorrhage was established as the cause of death.

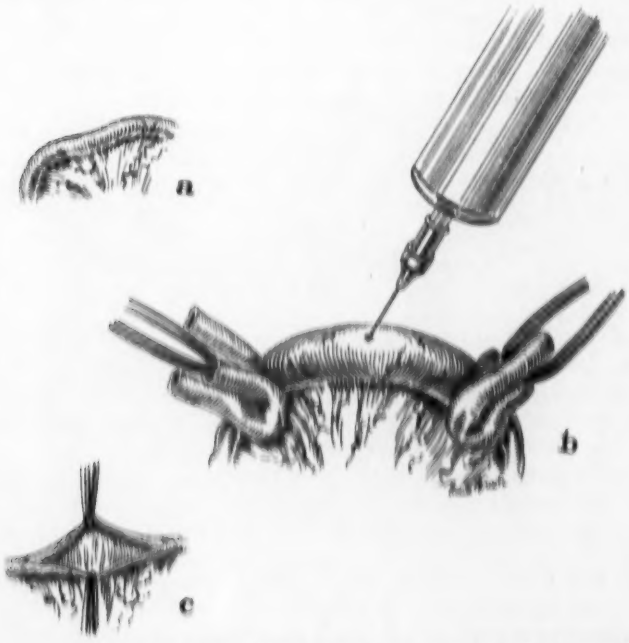


Fig. 7.—The actual size of the bowel distal to the atresia is shown in *a;* in *b* is shown the manner of dilating the intestine by the injection of air through a hypodermic syringe, and in *c* is shown the larger lumen of the bowel preserved even after incision of the wall of the bowel.

Case 11.—O., a white girl, was delivered at Ancker Hospital on Sept. 27, 1925. Artificial respiration was necessary for one hour, and the pulse remained weak until epinephrine was injected. Death occurred twelve hours after birth.

At autopsy, a group III alveolar cleft was present, the defect extending through the lip, the alveolar process and the hard and soft palate. When the peritoneal cavity was opened, a definite stenosis of the entire ileum was found; the caliber of the tract was less than one-half normal.

Case 12.—N., a white girl, at birth on May 25, 1926, weighed 1,800 Gm. The infant was admitted to the University Hospital on May 28, unable to retain food or water, with a history of projectile vomiting since the first day of life. There had been no bowel movements.

Examination showed a small infant, weighing 1,325 Gm., with a temperature of 100.4 F., rapid respiration, marked dehydration and slight icterus; no peristalsis was visible. One hundred cubic centimeters of a physiologic solution of sodium chloride was given intraperitoneally, and the infant was placed in a premature basket. Breast milk was given by gavage; 100 cc. of saline solution was later given subcutaneously. A small amount of meconium was passed. All of the feedings were regurgitated in small amounts; the infant became progressively weaker and died on May 29.

Autopsy showed an hourglass appearance of the stomach and the duodenum, with a constriction formed by a normal pylorus. There was complete atresia of the second portion of the duodenum at the head of the pancreas, 5 cm. from the pylorus. The diameter of the stomach was 5 cm., and that of the duodenum, 2.5 cm. The transverse colon was adherent to the dilated duodenum.

Case 13.—D., a white boy, was delivered at the Miller Hospital on Sept. 22, 1927, one of twins, weighing 2,600 Gm. He remained well for forty-eight hours after birth, during which time several brown stools had been passed; then he began regurgitating a thick greenish fluid. No stools were passed subsequently, but urination was frequent. Roentgen examination showed a dilated stomach and duodenum ending apparently in a blind pouch. At operation on October 2, the small intestine was found to be entirely disconnected at one point and not remediable by surgical intervention. Death occurred on October 4, at 12 days of age.

At autopsy the weight was 1,700 Gm. and the length, 45 cm. The stomach and duodenum were distended by gas, meconium and bismuth. At a point 17 cm. below the pylorus, the jejunum ended in a blind pouch. The colon was collapsed but otherwise normal. The small intestine measured 45 cm. in length and was tightly coiled, hanging free from the cecum and attached to the posterior abdominal wall at only one point, at which a cordlike portion of the mesentery, carrying an artery of supply, was attached to its usual site. The proximal end of this coiled segment was bifid, ending in two blind pouches of equal size and identical appearance.

Case 14.—G., a white boy, was delivered on Jan. 31, 1929, at the Swedish Hospital. Vomiting (not projectile) of yellowish-brown fluid occurred after most feedings. One stool was thought to contain food. Occult blood was found in the stool. Jaundice, subnormal temperature, loss of weight, dehydration and irregular respiration terminated in death on February 8.

Autopsy showed that the small intestine was collapsed; no meconium was found in the colon. The stomach was three times its normal size and filled with mucus, barium and gas. Six centimeters below the pylorus there was almost complete atresia of the duodenum. The duodenum above this point was greatly distended, having the shape of a normal stomach.

Case 15.—C., a white boy, was one of twins delivered on April 5, 1929, at St. Luke's Hospital. The infant passed no meconium and could not retain the feedings. Roentgen examination showed a narrow, ribbon-like colon, patent throughout; there was no pyloric stenosis, but a dilated and gas-filled small intestine was demonstrated terminating in a sausage-like dilatation. At operation, free fecal material was found in the peritoneal cavity. Enterostomy was performed, but death resulted subsequently.

Autopsy showed that the peritoneal cavity contained a small amount of brown fecal material. The small intestine was dilated to 2 cm. in diameter, with the exception of the terminal 2.5 cm. of the ileum, which was solid and cordlike,

5 mm. in diameter, with the lumen occluded. The colon was patent. Nine centimeters from the ileocolic junction, the ileum was gangrenous and ruptured.

Case 16.—W., a white boy, delivered at Ancker Hospital on May 31, 1929, died two hours after birth.

Autopsy showed that the peritoneal cavity contained a brown mucoid fluid filled with flakes of fibrin and possible fecal material. Coils of intestine were firmly sealed together by fibrinous exudate. The large intestine was a fibrous, cordlike structure, with an occluded lumen. The stomach and small intestine had a patent lumen. Cerebral hemorrhage and peritonitis were the causes of death.

Case 17.—M., a white girl, was admitted to St. Mary's Hospital on Jan. 26, 1929, at the age of 6 weeks, with inability to retain food. The vomiting was first noticed by the parents two weeks after the birth of the infant, when it was brought home from the hospital.

Physical examination gave negative results and roentgen examination (February 19) showed no obstruction. On February 26, a Rammstedt operation for pyloric stenosis was performed. The projectile vomiting ceased, but slight difficulty in retaining feedings persisted. The infant was tube-fed for two months, showing little gain in weight during this time. Diarrhea supervened in May. In June, there was an elevation in temperature to 104 F. with sepsis, blood in the stools and vomiting for one week, culminating in death.

At autopsy the peritoneal surfaces were found to be inflamed, and a plastic exudate was present. The stomach and upper part of the intestine were dilated, and the pylorus was patent. Adhesions were present about the operative wound. Fifty centimeters below the pylorus, there was a congenital stenosis of the ileum, causing almost complete closure of the lumen. Closure of the lumen was completed by a volvulus of the lower segment of the ileum. From a perforation above the obstruction in the bowel the intestinal contents oozed.

COMMENT

Examination of these records shows that the seventeen cases comprised thirteen of complete atresia and four of stenosis. The site of obstruction occurred in the duodenum seven times, in two instances above, and in five below, the papilla of Vater; in the jejunum twice; in the ileum and cecum in six instances; in the colon once and in multiple areas once. Eight of the infants in this series were boys and eight girls; the sex of one was not stated. A similar equal distribution was noted by Cordes,[2] who found fourteen male, thirteen female and thirty patients whose sex was not stated in fifty-seven collected cases. An association of other congenital anomalies was seen in two cases; hydramnios was reported in a like number. Of the seventeen cases, there was recourse to surgical intervention in seven; in several others, no opportunity for diagnosis was afforded, death occurring at or shortly after birth.

A survey of the literature indicates that the first report of this condition was made by Calder[3] in 1733. After that time a few cases

2. Cordes, L.: Congenital Occlusion of the Duodenum, Arch. Pediat. **18**:401 (June) 1901.

3. Calder: Two Examples of Children Born with Preternatural Conformation of the Guts, Med. Essays, Edinburgh **1**:203, 1733.

were reported at long intervals, but a thorough exposition of the subject was not made until 1877, when Theremin [4] wrote an excellent treatise. He reported having observed 2 cases over a period of eleven years among 111,451 children admitted to a foundling hospital in Vienna, and 9 cases among 150,000 children admitted to a similar institution in St. Petersburg. No cases had then been observed in the foundling hospitals in Moscow or Prague. In 1899, Braun [5] stated that among 1,980,304 living new-born infants in Germany, there were 118 cases of congenital intestinal occlusion. Ernst,[6] in 1916, reported 2 cases among 41,000 infants in Copenhagen. The relative frequency of this condition at autopsy is indicated by the figures of Miller, who, in 1894, reported 36 cases from a total of 65,000 autopsies at Moscow, and of Sheldon,[7] who, in 1926, stated that among 6,000 autopsies at the Hospital for Sick Children in London since 1900, there were 26 instances of congenital atresia and stenosis.

In 1901, Cordes [2] found 56 reported cases of atresia and stenosis of the duodenum alone, added another and gave an excellent tabulation of the conditions of this disorder. Kuliga [8] in 1903, collected 185 cases of atresia in the small and large intestine; in the same year Savariaud [9] reported that 89 patients had been treated surgically. In 1912, Spriggs [10] added 24 cases of atresia and stenosis from the museums of the Royal College of Surgeons and from some of the London hospitals, with excellent pathologic studies. Davis and Poynter [11] collected 392 cases from the literature up to the time of their report in 1922. Recently there have been numerous reports of additional cases. Farr and Fries [12] added 9 cases in 1925. Sheldon [7] contributed 25 cases in 1926. Loit-

4. Theremin, E.: Ueber congenitale Occlusien des Dünndarms, Deutsche Ztschr. f. Chir. **8**:34, 1877.

5. Braun, H.: Ueber den angeborenen Verschluss des Dünndarms und seine operative Behandlung, Beitr. z. klin. Chir. **34**:993, 1902.

6. Ernst, N. P.: A Case of Congenital Atresia of the Duodenum Treated Successfully by Operation, Brit. M. J. **1**:644, 1916.

7. Sheldon, W. P. H.: Congenital Atresia of the Alimentary Tract, Arch. Dis. Child. **1**:279 (Oct.) 1926.

8. Kuliga, P.: Zur Genese der congenitalen Dünndarmstenosen und Atresien, Beitr. z. path. Anat. u. z. allg. Path. **33**:481, 1903.

9. Savariaud: L'occlusion congénitale interne, Rev. d'orthop., 1903, series 2, p. 305.

10. Spriggs, N. I.: Congenital Intestinal Occlusion; An Account of Twenty-Four Unpublished Cases, with Remarks Based Thereon and Upon the Literature of the Subject, Guy's Hosp. Rep. **66**:143, 1912.

11. Davis, D. L., and Poynter, C. W. M.: Congenital Occlusions of the Intestines, with Report of a Case of Multiple Atresia of the Jejunum, Surg. Gynec. Obst. **34**:35, 1922.

12. Farr, C. E., and Fries, M.: Congenital Occlusion of the Bowel, S. Clin. North America **5**:621 (April) 1925.

man [13] 4 in 1927 and Baty [14] 12 in 1929. In 1929, Kaldor [15] stated that 250 cases of duodenal atresia were to be found reported in the literature.

Pathologic Process.—The most frequent site for the obstruction is in the lower ileum and jejunum, although it may be present at any point in the intestinal tract. In the 392 cases collected by Davis and Poynter,[11] the following tabulation gives the location of the atresia:

Duodenum, above the papilla	59
Duodenum, below the papilla	75
Jejunum	60
Ileum and cecum	101
Colon	39
Multiple areas	67

In the cases collected by Tandler,[16] the occlusion was found to be present in the duodenum 33 times, in the jejunum and ileum 55 times and in the colon 6 times. Vallois and his associates [17] in a collection of 224 cases, gave the percentage of occurrence as in the duodenum in 33 per cent, in the jejunum and ileum in 53 per cent and in the large intestine in 10 per cent of instances. Of the duodenal cases alone, Cordes,[9] in a total of 57 cases, found the obstruction above the orifice of the common bile duct in 20, below in 13 and at the level of the duct in 2; the others were not classified. In a more recent report of 113 cases by Garvin,[18] the site of obstruction was described as above the papilla in 34, opposite the termination of the common bile duct in 19, below in 25 and at the duodenojejunal flexure in 19, while 16 remained unclassified.

The obstruction is usually single, but in about 15 per cent there are multiple areas of atresia. In the multiple cases, Davis and Poynter [11] found, in slightly more than 50 per cent, from two to nine occlusions in the jejunum and upper ileum. In multiple constrictions, stenosis and atresia may coexist. The point of obstruction may be narrow or moderately wide. Above the level of obstruction, the bowel is usually dis-

13. Loitman, C.: Congenital Occlusion of the Intestine, with Report of Four Cases, Boston M. & S. J. **197**:21 (July 7) 1927.

14. Baty, J. M.: Congenital Atresia of the Intestine, Am. J. Dis. Child. **37**:591 (March) 1929.

15. Kaldor, J.: Atresia of the Duodenum and Duodenal Diverticula, Ann. Surg. **89**:6 (Jan.) 1929.

16. Tandler, J.: Zur Entwicklungsgeschichte des menschlichen Duodenum in frühen Embryonalstadien, Morphol. Jahrb. **29**:187, 1902.

17. Vallois, L.; Coll de Carrera, J.; Guibal, A., and Chaptal: À propos de l'occlusion intestinale aiguë chez le nouveaux-né; un cas d'oblitération congénitale de l'intestin grêle, Bull. Soc. d'obst. et de gynec. **16**:161 (Feb.) 1927.

18. Garvin, J. A.: Congenital Occlusion of the Duodenum, Am. J. Dis. Child. **35**:109 (Jan.) 1928.

tended, in some instances so markedly that the pyloric ring is obliterated, or rupture of the bowel may occur (case 15). Hypertrophy of the intestinal wall above the obstruction occurs, regularly, as shown in the accompanying photographs (fig. 4) from case 1 of our series. Below the obstruction, the bowel is constricted and often ribbon-like, especially in low obstructions. The presence of bile in the contents of the lower bowel depends usually on the site of obstruction as related to the common bile duct. In some cases, however, bile-tinged meconium has been reported to have been present in the colon with complete obstruction of the duodenum below the papilla of Vater (Cordes [9]). For this occurrence the presence of an anomalous bile duct or the development of the atresia after the fifth fetal month, at which time bile is normally present in the intestine, has been offered in explanation.

The degree of constriction may vary from stenosis to complete obstruction; an interruption—a gap in the bowel with or without the absence of the corresponding mesenteric segment—may exist. There may be a cordlike structure connecting the segments of bowel, which may contain all the layers of the intestinal wall, or its component parts may be unrecognizable. The photograph (fig. 6) of a section through the connecting structure from case 1 of our series shows that it is made up altogether of fibrous tissue. Sheldon [7] reported a case in which microscopic section through the connecting band showed all the normal intestinal layers to be present, with the mucosa completely fused. Absence of a segment of bowel has been reported by numerous authors. Erb [19] reported an instance of interruption of continuity of the jejunum, with isolation of a small segment, both ends of which were closed. Thomas [20] reported the complete absence of the duodenum, the ileum and the greater portion of the colon. In one of our cases (case 13) there was not only interruption of continuity, but almost complete absence of mesentery.

Etiology.—Numerous theories have been advanced to explain the occurrence of intestinal atresia. Widest credence is given to the theory that these areas of occlusion are due to the persistence of epithelial buds in the intestine. In describing the development of the elasmobranch, Balfour [21] referred to it as a solid organ and pointed out that only later did it acquire a lumen. Tandler [18] showed that the duodenum in human embryos between 30 and 60 days of age is solid, and he

19. Erb, I. H.: A Rare Case of Multiple Congenital Atresia of the Ileum with Complete Separation of a Segment of Bowel, Am. J. Path. 2:137, 1926.

20. Thomas, W.: Complete Absence of Jejunum, Ileum and the Greater Part of the Colon, Lancet 1:63 (Jan. 12) 1884.

21. Balfour, F. M.: A Monograph on the Development of Elasmobranch Fishes, London, J. E. Adlard, 1878.

suggested that the atresia found in congenital occlusion is due to failure of the bowel to acquire a lumen. Kreuter,[22] who gave the subject intense study in human embryos, concurred in this opinion. Cautley [23] referred to the work of Ager, who stated that the duodenum in embryos of about 12 mm. (fifth fetal week) is temporarily obliterated, and that the development of the liver and pancreas from duodenal diverticula or buds at about the same time increases the possibility for the occurrence of developmental error.

However, Schridde [24] stated that he examined the esophagus in a number of embryos and never observed a stage in which a lumen was not present. Forssner [25] observed the presence of vacuoles in the esophagus and in the duodenum. In the esophagus he found that the continuity of the lumen was not impaired by the presence of these vacuoles, whereas in embryos of 16 mm. the epithelium throughout the extent of the duodenum was full of large vacuoles. He expressed the opinion that occurrence of atresia is due, not to arrested development, but to overdevelopment of the "mesenchym Zapfen" or forerunners of the villi. In embryos, from 20 to 30 mm. in size, these grow into the bowel and extend into the lumen so far that a mesenchymal bridge or diaphragm is formed. Stenosis may result at first, later to be transformed into atresia. Johnson,[26] who studied the development of the chick's intestine, found vacuoles present in the duodenum and jejunum of 16 mm. embryos. The lumen of the lower jejunum and ileum was pervious throughout its entire length.

Inflammatory reaction as the chief factor in the production of congenital atresia has many advocates, starting with Fiedler [27] and Savariaud.[9] They cited inflammatory vestiges, in the form of adhesions and bands, as supporting evidence. Theremin [4] has been a strong advocate of the theory of fetal peritonitis as the causative factor.

Another group urges vascular changes as an etiologic factor. Jaboulay [28] thought that a lack of anastomosis of the mesenteric arte-

22. Kreuter: Zur Aetiologie der congenitalen Atresien des Darms und Oesophagus, Arch. f. klin. Chir. **88**:302, 1909.

23. Cautley, E.: Duodenal Stenosis, Brit. J. Child Dis. **16**:65, 1919.

24. Schridde, H.: Ueber die Epithelproliferationen in der embryonalen menschlichen Speiseröhre, Virchows Arch. f. path. Anat. **181**:178, 1908.

25. Forssner, H.: Die angeborenen Darm und Oesophagus Atresien, Anat. Hefte **34**:1, 1907.

26. Johnson, F.: The Development of the Mucous Membrane of the Oesophagus, Stomach and Small Intestine in the Human Embryo, Am. J. Anat. **10**:521, 1910.

27. Fiedler: Arch. f. Kinderh. **5**:78, 1864.

28. Jaboulay: À propos de la pathogénie de l'imperforation de l'iléon et de l'imperforation ou des rétrecissements congénitaux des conduits naturels, Compt. rend. de l'Ass. d. anat., 1901.

ries was a factor in many cases. Durante considered obliterative lesions of the mesenteric vessels as a causative factor. Davis and Poynter found a sclerosis of the mesenteric arteries in their case, which they believed to be the primary lesion. Wyss [29] observed a failure of development of the vessels at the atresic area, but this is generally considered a result rather than a cause of intestinal atresia.

In 1889, Bland-Sutton [30] offered the theory that disturbance in development of the intestine occurred at the site of embryologic events, pointing out the frequency of alterations at the duodenum and duodenojejunal juncture, the ileum in the vicinity of Meckel's diverticulum and the ileocecal region.

Other causes that have been mentioned are kinking of the bowel, fetal intussusception, strangulation through a mesenteric orifice, volvulus, hypertrophy of the valvulae conniventes, pressure at the head of the pancreas, anomalies in development of the intestinal mucosa and syphilis. An interesting observation made in reviewing our series is the high percentage of prematurity, as evidenced by body length or weight. Cordes noted prematurity in sixteen of a total of fifty-seven cases of duodenal obstruction, and in discussing this observation, said that Schottelius thought that it favored syphilis as a causative factor. The frequent occurrence of prematurity has also been noted by Pehu and Auberge.[31]

Perhaps no one of these factors will adequately account for all cases of intestinal atresia, but the failure of a portion of the intestine to acquire a normal lumen during its developmental period would seem the most plausible.

Symptoms.—A review of our case reports and of the literature indicates that the most frequent and prominent symptoms of congenital intestinal obstruction are vomiting, abdominal distention, absence of stool or diminution in the number of stools and absence of bile in the stools. The infant usually seems normal and takes its feedings well for a few hours or the first day. In nearly all cases, regurgitation or vomiting starts within twenty-four hours, although Helmholtz [32] and Farr and Fries [12] observed cases in which no vomiting occurred up to the time of death at 2 and 8 days of age, respectively. The inception of vomiting is usually related to the location of the obstruction; it occurs

29. Wyss, M. O.: Ueber kongenitale Duodenal-Atresien, Beitr. z. klin. chir. **26**:631, 1900.

30. Bland-Sutton: Imperforate Ileum, Am. J. M. Sc. **98**:457, 1889.

31. Pehu, M., and Auberge, A.: Les retrécissements congénitaux du duodénum observés chez l'enfant, Arch. de méd. d. enf. **27**:321, 1924.

32. Helmholtz, H.: Two Cases of Atresia of the Small Intestine, Bull. Johns Hopkins Hosp. **18**:370, 1907.

earlier in cases of duodenal obstruction than in those in which obstruction is lower in the tract, although our series showed little correlation. The presence of bile in the vomitus depends on the location of the obstruction above or below the opening of the bile duct, as previously discussed. In some instances (case 1), fecal vomiting is described. The vomiting may early become projectile. Hematemesis, reported as frequent by some authors (65 per cent of cases collected by Cowell [32a] in 1912), was not noted in any of the cases here reported.

There may be an absence of stools, although frequently one or two passages of meconium or mucus occur. In one of our cases (case 2), a striking history of movements, normal in number, amount and color during the first day, diminishing to practically no stool on the sixth day, was obtained. The expulsion of meconium untinged by bile pigment, when associated with vomiting, is presumptive evidence of intestinal atresia. In those instances in which the intestinal occlusion is above the terminal common bile duct, bile colored meconium is the rule. The spontaneous evacuation of stools or the effectual return of meconium and gas are frequently relied on to militate against the presence of intestinal obstruction, and a general unwillingness exists to accept this diagnosis as long as effectual results are obtained by enemas. The fallacy of such a contention has been adequately shown by one of us (O. H. W.) and Goehl.[33] In dogs with complete obstructions, gas and feces were obtained regularly from the lower bowel following the administration of Noble's enemas. By introducing tiny balloons into the bowel distal to the obstruction in such animals, Carlson and one of us (O. H. W.)[34] were able to show that the bowel distal to the obstruction is physiologically, as well as anatomically, normal. Why should it not permit the spontaneous evacuation of stools or the effectual return of enemas? Ineffectual enemas are significant of the presence of a low obstruction. To defer the diagnosis of intestinal obstruction because results are obtained with enemas is an irrational procedure.

Physical Symptoms.—Abdominal distention is marked in some cases, especially in those with low obstruction. Distention is, however, a late sign. With duodenal obstruction, distention is usually minimal or absent; when it is present, only the upper part of the abdomen is distended.

32a. Cowell, E. M.: Congenital Occlusion of the Duodenum, Quart. J. Med. **5**:401, 1911-1912.

33. Wangensteen, O. H., and Goehl, E. O.: The Evaluation of the Expulsion of Enemas as a Criterion of Intestinal Obstruction, Arch. Int. Med. **46**:669 (Oct.) 1930.

34. Carlson, H. A., and Wangensteen, O. H.: Motor Activity of the Distal Bowel in Intestinal Obstruction: Comparison with the Obstructed and Normal, Proc. Soc. Exper. Biol. & Med. **27**:676, 1930.

Visible peristaltic waves are not frequent. Peristalsis is a pathognomonic sign of obstruction when visible, but it is usually observed only in subacute or chronic types of obstruction. Stethoscopic examination of the abdomen, however, frequently reveals loud intestinal borborygmi significant of the presence of a mechanical block in the bowel.

After a few days jaundice will occur if the intestinal occlusion is below the common bile duct. The frequency of jaundice in normal new-born infants, however, renders this condition of lesser consequence.

As a result of the loss of fluid and the lack of absorption, dehydration is frequently evidenced by anuria, poor tissue turgor, depression of the fontanel, loss in weight and fever caused by dehydration.

Roentgen examination of the abdomen is of considerable value in establishing the presence of intestinal obstruction. When a single plate is taken of the abdomen after the onset of vomiting, gaseous shadows may be made out in the small intestine; when the plate is made with the infant held in the erect posture, distinct levels or mirrors of fluid may be observed. These are significant of the presence of gas over fluid.

Although gas is normally present in the small intestine, its intermixture with the fluid present in the small intestine is so intimate that it fails to show on a flat plate made of the abdomen in adults and in older children; gas is, of course, normally visible in the stomach and in the colon. When an interruption of the continuity of the intestine occurs, gas and fluid accumulate above the obstruction, and then its detection in the small intestine is usually significant of intestinal stasis. In an experimental study of simple intestinal obstruction in dogs, one of us (O. H. W.) and Lynch[35] found that gaseous distention of the small intestine could usually be made out four or five hours after the intestinal occlusion. Evidence of the existence of intestinal stasis by roentgen examination may therefore be obtained at an early hour. But it must be remembered that in peritonitis a paralytic or inhibitive ileus occurs, in which the entire intestine participates in the distention. The detection of gas in the small intestine in the adult and in older children is indicative of intestinal stasis; the stethoscope, however, will serve to differentiate whether the obstruction is mechanical or inhibitive. In the former, loud intestinal borborygmi are to be heard; in the latter, the abdomen is relatively silent.

In roentgenograms of infants, however, gas may be constantly observed in the small intestine. Its presence in the infant with suspected obstruction of the bowel is not of the same significance as it is in adults

35. Wangensteen, O. H., and Lynch, F. W.: Evaluation of X-Ray Evidence as a Criterion for Intestinal Obstruction. Proc. Soc. Exper. Biol. & Med. **27**:674, 1930.

and older children. Roentgen examination, however, indicates unequivocally that abnormal intestinal distention is present, and in the presence of exaggerated intestinal noises, this evidence is of considerable importance in establishing the diagnosis of obstruction of the bowel.[35a]

In cases of high or low atresia, the administration of barium by mouth or by enema is of value. In most instances, however, it is an unnecessary procedure. In case 2 of our series, in which bile-colored stools were present, the administration of barium by mouth gave unmistakable evidence of the atresia present in the first portion of the duodenum.

Differential Diagnosis.—Esophageal stricture usually gives a history of regurgitation immediately after the ingestion of the first food or water. Cyanosis is present after the taking of fluids in cases in which there is a communication of the esophageal stricture with the trachea. Passage of a rubber catheter will establish a definite diagnosis.

The presence of imperforate anus is easily established by digital examination or exploration with a sound. It might be mentioned here that roentgen examination of the abdomen in the inverted posture as described by one of us (O. H. W.) and Rice [36] indicates the length of the impervious area in atresia of the anal canal and rectum. When the child is held upside down, the gas rises toward the anal area, and accurate information is obtained concerning the magnitude of the procedure necessary to correct the deformity.

Pyloric stenosis must be excluded. Complete atresia is differentiated from this condition by a study of the stools for the presence of food, and by roentgen observations after a barium meal; since there is seldom more than 80 per cent gastric retention in pyloric stenosis, the invasion of the upper reaches of the intestine by barium rules out complete intestinal atresia. Congenital intestinal stenosis is more difficult to distinguish from pyloric stenosis. Stenosis, however, is even rarer than complete atresia; in addition, congenital stenosis or atresia causes marked symptoms shortly after birth; pyloric stenosis seldom does so before the second or third week.

Among other causes of intestinal obstruction in the new-born, herniation through an aperture in the mesentery must be considered, but absence of bile in vomitus or stool would make a diagnosis of congenital atresia likely.

35a. In case 2, no gas was observed in the small intestine on the roentgenogram. The complete separation of stomach and duodenum would preclude the presence of gas from the two common sources, namely, swallowing air and intestinal bacterial activity.

36. Wangensteen, O. H., and Rice, C. O.: Imperforate Anus: A Method of Determining the Surgical Approach, Ann. Surg. 92:77 (July) 1930.

Prognosis.—The outlook is necessarily poor. In cases with complete obstruction, Cordes found that death occurred from thirty hours to nine days after birth; Davis and Poynter found that the average life of infants in all cases was six days; in duodenal obstruction it was five days. In 1912, Spriggs [10] found that eighty-two infants had been operated on without recovery. A few infants with total occlusion have survived for a surprisingly long time; Theremin [4] described an infant with complete atresia of the lower ileum that lived three weeks.

Many patients with partial occlusion have lived for a long time, some into adult life. Carling [37] reported the case of a man aged 47, with congenital stricture of the duodenum. Judd and White [38] recently reported two instances of obstruction of congenital origin at the duodenojejunal angle in patients, 19 years of age. Cannon and Halpern [38a] recorded the instance of a child who had periodic attacks of obstruction and died at the age of 8 years from perforation of the stomach. A membranous septum at the level of the papilla of Vater, exhibiting only a small iris-like aperture, was responsible for the obstruction.

Treatment.—In the treatment of older children and adults for intestinal obstruction the surgeon determines the best operative procedure by the general condition of the patient. In an obstruction of short duration, the operation of election, namely, immediate restoration of the continuity of the bowel, may be done; in a patient with considerable intestinal distention and acute obstruction of long duration, the surgeon contents himself with an operation of necessity, and decompresses the dilated intestine by enterostomy. In obstruction by strangulation, the viability of the bowel concerned rather than the patient's ability to tolerate alternative operative procedures must determine the mode of action.

In conformity with these principles, it would appear that the operation of lesser risk for the infant with intestinal atresia would be the performance of enterostomy. It is a significant fact, however, that all of the patients in whom enterostomy has been done have died. In 1902, Braun [8] collected nineteen cases of congenital atresia of the intestine, in which enterostomy had been done, with a lethal outcome in every instance. Tischendorf,[39] operating on an infant, 6 days old,

37. Carling, E. R.: Three Cases Illustrating the Surgery of the Jejunum, Brit. M. J. **1**:435 (Feb. 19) 1910.

38. Judd, E. S., and White, R. B.: Congenital Anomalies of the Duodenum with Obstruction at the Duodenojejunal Angle, Ann. Surg. **89**:1 (Jan.) 1929.

38a. Cannon, P. R., and Halpert, B.: Congenital Stenosis of the Third Portion of the Duodenum with Acute Occlusion and Rupture of the Stomach, Arch. Path. **8**:611 (Oct.) 1929.

39. Tischendorf, V.: Enterostomie bei angeborener Atresie des Ileum, Centralbl. f. Chir. **14**:69, 1887.

found an obstruction 25 cm. above the ileocecal valve. The child survived enterostomy for fifteen days, which Braun thought was an indication that this was the operation of choice for all cases of low atresia. Braun made his report, however, nine years before the first successful operation for intestinal atresia.

In 1911, Fockens [40] of Rotterdam reported the first successful operative intervention for the relief of this condition. The case concerned an infant, aged 7 days, with atresia at the juncture of the middle and lower thirds of the small intestine. There was a defect about 4 cm. in length in which the intestine was absent, the proximal and distal ends of the bowel being closed. A side-to-side anastomosis was made, with recovery of the patient. When Fockens made his report five months later, the child was well.

In 1916, Ernst [8] performed a successful duodenojejunostomy for duodenal atresia in an infant, aged 11 days. Loitman [13] referred to two other cases of high atresia in which gastro-enterostomy was successfully performed for congenital occlusion, both patients being well some time later. Richter [41] recorded the instance of an infant, aged 4 days with duodenojejunal atresia on whom he performed a successful posterior gastro-enterostomy. A volvulus of the ileum was also successfully reduced. In 1927, Weeks and Delprat [42] reported a successful gastro-enterostomy, performed in 1916, for congenital occlusion of the third portion of the duodenum in an infant, aged 6 days. In the discussion of MacLennan's [43] paper on acute intestinal obstruction in infancy and childhood, H. C. Cameron mentioned that a patient with congenital duodenal atresia had been operated on by Mr. Steward, with complete recovery. Sweet and Robertson [44] reported a successful issue after two operations on an infant for duodenal atresia. The infant was first operated on on the ninth day of life, a gastro-enterostomy being performed. Twelve days later, because of continued vomiting, a second operation was done, uniting the anterior aspect of the second portion of the duodenum to the jejunum distal to the initial anastomosis. Four months later, the child was in good health. Demmer [45] recently

40. Fockens, P.: Ein operativ geheilter Fall von kongenitaler Dünndarmatresie, Zentralbl. f. Chir. **38**:532, 1911.

41. Richter, H. M.: Abt, I. A., Pediatrics, Philadelphia, W. B. Saunders Company, 1924, vol. 3, p. 512.

42. Weeks, A., and Delprat, G. D.: Congenital Intestinal Obstruction, S. Clin. North America **7**:1193 (Oct.) 1927.

43. MacLennan, A.: Acute Intestinal Obstruction in Infancy and Childhood, Brit. M. J. **2**:818 (Nov. 5) 1927.

44. Sweet, G. B., and Robertson, C.: A Case of Congenital Atresia of the Jejunum with Recovery, Arch. Dis. Child. **2**:186 (June) 1927.

45. Demmer, F.: Atresia ilei; Resectio ileocoecalis; Heilung, Arch. f. klin. Chir. **147**:471, 1927.

reported a successful outcome in a case similar to that of Fockens. He resected the vestige of the terminal ileum and cecum and anastomosed the proximal ileum to the cecum.

These nine operative triumphs attest the fact that intestinal atresia is not irremediable. They further indicate that an anastomotic procedure is the only operation that holds any promise of success. The establishment of a complete external small intestinal fistula in the infant is doomed to failure from the start. Birgfeld [46] recently reported the instance of an infant, aged 50 hours, on whom he performed a side-to-side anastomosis for atresia of the upper part of the ileum. An enterostomy was also added. Although the fistula closed in three weeks, vomiting and distention recurred, necessitating a second operation at 4 weeks of age, following which the patient died.

Two factors contribute equally to the extreme difficulty and hazard in the surgical treatment for congenital intestinal atresia. A new-born infant with intestinal obstruction is a poor operative risk; these patients tolerate the loss of vital fluids poorly. And the small lumen of the bowel into which the fluid from the proximal portions of the intestine have never made their entry presents an excessively difficult technical problem. The performance of an intestinal anastomosis on such a bowel with preservation of an intestinal lumen frequently appears to be an impossible task.

This circumstance was encountered in case 2 in this series. When the collapsed segment selected for the anastomosis was inflated with air, however, an immediate dilatation of the intestine took place with distention of the lumen sufficiently great to permit of easy suture. Following the engagement of the proximal distended bowel or stomach, selected for the site of the anastomosis, in a soft rubber-covered clamp, it is also a good plan to deflate this dilated segment of bowel by aspiration of the content of the segment with a hypodermic needle and syringe. This procedure not only does away with soiling, but also permits the thinned-out wall of the bowel to shrink. Only a fine silk is to be employed in the suture. A single running suture by the Connell method will usually give a satisfactory anastomosis. A few additional interrupted sutures will give added security and adequate strength. Catgut is to be avoided in the suture of such delicate tissues, because puncture wounds that the suture fails to fill are not infrequently caused when catgut mounted on a needle is drawn through the wall of the bowel.

It is essential to administer saline solution subcutaneously to the infants who have not been able to utilize ingested fluids. They must

46. Birgfeld, E.: Zur kongenitalen Dünndarmatresie, Zentralbl. f. Chir. **55**: 1548 (June 23) 1928.

also be kept adequately warm by the external application of heat. The performance of the operation with all possible dispatch is important. Everything must be in readiness before the operation is begun. Infiltration of the abdominal wall with procaine hydrochloride will usually suffice; reenforcement with light ether anesthesia may be necessary. It is a good plan to attach two Allis clamps to the skin on both sides of the wound. If there is any straining during the exploration, the skin may be pulled together across the wound, and a threatened evisceration is thus easily obviated.

SUMMARY

Seventeen additional cases of congenital atresia of the intestine are added to those already reported in the literature. Two of these came under our observation. Correct preoperative recognition of the condition was made, and both patients were submitted to operation, with, however, a fatal issue. After ballooning the distal collapsed segment by the injection of air through a hypodermic needle, a seemingly impossible intestinal suture in case 2 was converted into an easy anastomosis. The infant died of parenchymatous hemorrhage in the wound, as disclosed by postmortem examination; the anastomosis was satisfactory and was found to be air and water tight.

The importance of the visualization of gaseous shadows and mirrors of fluid in the recognition of the condition on roentgen examination of the abdomen is pointed out. Although the oral and rectal administration of barium in most cases of acute intestinal obstruction is to be deliberately omitted in intestinal atresia, the procedure affords information as to the location of the obstruction, and helps to decide whether or not the atresia is multiple.

Nine cases of infants who survived operation are compiled from the literature; in each instance an anastomotic procedure was performed. No instance of recovery following enterostomy has occurred.

STREPTOCOCCI ISOLATED FROM EXCISED TONSILS AND POSTTONSILLECTOMY BLOOD CULTURES

A PRELIMINARY REPORT *

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That infections frequently follow certain operations and are sometimes a direct result of bacteria being thrown into the blood stream at operation seems to be generally accepted. This study was undertaken in an effort to determine, if possible, how frequently bacteremia followed tonsillectomy, and in cases in which such a condition occurred, what relation the organisms causing the bacteremia bore to the flora of the interior of the excised tonsils. It was thought that if bacteremia did develop, a localization might readily occur and manifestations of rheumatic disease appear.

TECHNIC

Tonsils.—After removal, the tonsils were brought to the laboratory without preservative. They were washed three times in sterile saline, about 50 cc. being used for each washing. The tonsil was held firmly in a hemostat, seared and laid open. The inner surface was scraped with a platinum loop, and a broth tube seeded. From this two loopsful were inoculated into beef heart blood agar and incubated. The next morning the plates were examined for characteristics of colonies, and fishings were made. Smears were made from the broth tubes, stained and examined for morphology. A note was made of the different kinds of bacteria found.

Blood Cultures.—Cultures were taken before operation as controls and again afterward. About 10 cc. was withdrawn into a 50 cc. tube, and left on ice over night. In the morning the specimen was centrifugated, the serum discarded and the clot inoculated into beef heart broth, made according to the method of Cecil.[1] Incubation was continued for thirty days, subcultures being made every fifth day in the Cecil medium.

Streptococci.—Smears were made from the cultures obtained from the blood agar plates and stained with Löffler's methylene blue (methylthionine chloride, U. S. P.). Whenever bacilli were found, a Gram stain was also made. If there was any doubt of the purity of a culture, it was replated and refished. Fermentation reactions were tested on lactose, salicin and mannite, in Hiss serum water, with the Andrade indicator. Incubation was continued for seven days.

* Submitted for publication, Sept. 17, 1930.

1. Cecil: J. Exper. Med. **50**:617, 1929.

RESULTS

Study of Stained Smears from Broth.—Streptococci were present in 85 per cent of all tonsils, staphylococci in 75 per cent and fusiform bacilli in 36 per cent. Diphtheroids, yeasts and gram-negative bacilli each occurred in a small number of cases. Most of the cultures were mixed, streptococci alone being found in 11 per cent.

Blood Agar Plates.—Hemolyzing streptococci were present on 72 per cent of the plates, green in 16 and indifferent in 6 per cent. Miscellaneous colonies, which proved to be staphylococci or gram-negative bacilli, appeared in 5 per cent of the plates. Pneumococci were not found in any case.

Streptococci Isolated from the Tonsils.—In all, 209 streptococcus cultures were isolated and studied from 78 cases. Forty-three per cent of these were *S. pyogenes,* 29 per cent *S. infrequens* and 14 per cent *S. anginosus, S. subacidus, S. equi* and *S. hemolyticus* I, II and III (Holman) were each found in a few instances. The only alpha types met were *S. mitis, S. fecalis, S. ingravus* and *S. salivarius.* No one of the alpha strains was found in more than 1 per cent of cases.

Blood Cultures.—A considerable number of blood cultures had to be discarded because of contamination with aerobic spore-bearing bacilli, which appeared during the thirty day period of incubation. The method used involves a great deal of handling, and perhaps a high percentage of contamination is inevitable. However, it is hoped that with more practice the technic will improve and that fewer cultures will have to be discarded because of contamination. In sixty-four cases, blood cultures went through the incubation period without gross contamination. Fifty-four cases (85 per cent) were negative, and ten (15 per cent) showed growth after an average incubation of eight days. In four cases beta streptococci were present; in one an alpha strain was also found. The types represented were *S. pyogenes, S. infrequens, S. equi, S. anginosus* and *S. salivarius.* This is 40 per cent of the positive cases and 6 per cent of the total number of postoperative blood cultures. In three cases streptococci and staphylococci were present together. A diphtheroid bacillus and a gram-negative bacillus fermenting lactose were found in one case each.

COMMENT

No information of any value was obtained from a study of the morphology of the streptococci growing either in the original cultures from the scrapings of the inner surface of the tonsils or in the pure cultures. In general, the individual cocci of the beta varieties were round and in long chains, while those of the alpha type tended to be

somewhat flattened and in shorter chains. These observations were of course anticipated. The stain used, Löffler's methylene blue, was selected because it seemed to bring out the morphology better than several others tried, and was simple to use. Gram stains were made, as has been said, only when there seemed to be an indication for their use. These stains were of no value in the study of the morphology.

Among the many reports of the bacteriology of infections of the throat, few deal with bacteria from excised tonsils, and none of these classifies the streptococci. For comparison of the results, then, it is necessary to study classifications of bacteria isolated from the throat and the upper respiratory tract. Naturally, any organisms that inhabit these areas may become the infecting agent of the tonsils, and so are of interest in interpreting these results. Julianelle [2] made a bacteriologic study of extirpated tonsils and found that the hemolyzing streptococci were present in 90 per cent of the cases, staphylococci in 62 and *Streptococcus viridans* in 31 per cent. Kilduffe and Hersohn [3] examined 409 tonsils and found pneumococci in 24 per cent, staphylococci in 43 per cent, hemolyzing streptococci in 2 per cent and nonhemolyzing streptococci in 5 per cent. Polvogt and Crowe,[4] who studied streptococci isolated from excised tonsils, found 91 per cent hemolyzing streptococci. Felty and Bloomfield [5] did not classify the strains they isolated during an outbreak of acute tonsillitis, but from their table it would seem that they found *S. pyogenes* and *S. equi* most frequently. Arnold,[6] in examining a series of normal throats, found that the most common beta types were *S. subacidus, S. equi* and *S. hemolyticus* II, while among the alpha types *S. equinus, S. salivarius* and *S. mitis* occurred most often. He stated that the notable absence of *S. pyogenes* may be due to the fact that infected throats were excluded as far as possible. Cobe,[7] in studying the incidence of bacteria in 400 tonsils, found that the predominating organism was staphylococcus. Pneumococcus and *Streptococcus hemolyticus, nonhemolyticus* and *viridans* were also found. Most of the streptococci belonged in the *S. salivarius* group. Three per cent of the nonhemolytic streptococci were identified as *S. cardio-arthritis*. Frost [8]

2. Julianelle, L. A.: J. Lab. & Clin. Med. **9**:699, 1924.

3. Kilduffe, R. A., and Hersohn, W. W.: J. Lab. & Clin. Med. **12**:788, 1927.

4. Polvogt, L. M., and Crowe, S. J.: Predominating Organisms Found in Cultures from Tonsils and Adenoids, J. A. M. A. **92**:962 (March 23) 1929.

5. Felty, A. R., and Bloomfield, A. L.: Bull. Johns Hopkins Hosp. **34**:379, 1923.

6. Arnold, L.: J. Lab. & Clin. Med. **5**:587, 1920.

7. Cobe, H. M.: Incidence of Bacteria in Four Hundred Tonsil Cultures, J. Infect. Dis. **46**:298 (April) 1930.

8. Frost, W. D.; Thomas, R. C.; Gumm, M., and Shaw, M.: Am. J. Pub. Health **11**:1081, 1929.

and his co-workers, in a study of septic sore throat, both patients and contacts, found *S. pyogenes, S. anginosus* and *S. mastiditis.* Holman,[9] in his complete tabulation of streptococci from various sources, analyzed 620 streptococci from the throat. He found that *S. pyogenes, S. anginosus* and *S. infrequens,* respectively, were the most common. Among the alpha strains, *S. salivarius, S. mitis* and *S. ignavus* predominated. Hooker and Anderson[10] summarized the observations in more than 4,000 strains from the respiratory tract. From this area, alpha strains predominated, *S. salivarius, S. mitis, S. ignavus* and *S. equinus* being the most common. They found that of the beta types, *S. anginosus, S. infrequins, S. subacidus* and *S. equi* were present in the order given.

In this study of cultures from the inner surface of excised tonsils, there was a variation in the order of incidence, as is shown in table 1. Whether this variation is real or apparent, or what significance it may

TABLE 1.—*Summary of Strains of Streptococci Found in the Throat*

	Arnold	Frost	Holman	Hooker	Authors' Tonsils Only
Beta types	S. subacidus	S. pyogenes	S. pyogenes	S. pyogenes	S. pyogenes
	S. equi	S. anginosus	S. anginosus	S. anginosus	S. infrequens
	S. hemolyticus	S. mastiditis	S. infrequens	S. infrequens	S. anginosus
Alpha types	S. equinus	S. salivarius	S. salivarius	S. salivarius	S. mitis
	S. salivarius		S. mitis	S. mitis	S. fecalis
	S. mitis		S. ignavus	S. ignavus	S. ignavus

have, will have to be answered after many more tonsils have been examined. It may be that the change in frequency of both alpha and beta types indicates variations in the invasive power of the different strains. In 45 per cent of the tonsils, only one strain was found; in 40 per cent two, and in 5 per cent three.

The percentage of fusiform bacilli found in the inner surface of tonsils has seemed of particular interest and is far greater than was expected. These organisms are not generally supposed to be invasive, and their appearance in 36 per cent of the cultures is hard to explain. It is possible, of course, that they were carried in from the outside of the tonsil, and it is hoped that further work will answer this question. However, although the technic used was not especially favorable to their growth, they were found in more than a third of the cases.

There seem to be only two reports in the literature of blood cultures taken specifically to determine whether bacteria are thrown into the blood

9. Holman, W. L.: J. M. Research **34**:349, 1916.

10. Hooker, S. B., and Anderson, L. M.: J. Immunol. **16**:281, 1929.

stream as a result of tonsillectomy. Rubin, Epstein and Werner [11] took cultures before operation as controls, during or immediately after operation and six or ten hours later in seventy-eight cases. Cases of recent history of infection of the throat were selected. No cultures were positive. Schwarz and Frisch [12] reported that in eleven tonsillectomies in children with a history of rheumatism, hemolyzing streptococci were found in three of the blood cultures taken during the operation. In a fourth case, an anaerobic anhemolytic streptococcus was present. None of the cultures taken two hours after the operation were positive.

In this work, the time for taking the postoperative blood cultures was rather arbitrarily selected at two hours. It was felt that any bacteremia would be transitory, but that sufficient time should be allowed for the ether to disappear from the circulating blood. Recently shorter intervals have been tried and will be reported later. However, it may be said that the results have not been so good as when the longer interval was used. In three of the four cases in which streptococci were found, the

TABLE 2.—*Strains Found in Tonsils and Blood After Operation*

	L. M.*	Y. C.	Mrs. McK.	A. P.
Tonsil	S. infrequens S. progenes S. equi	S. infrequens	S. progenes S. hemolyticus S. fecalis	S. progenes
Blood	S. infrequens S. progenes S. equi	S. infrequens	S. progenes S. anginosus S. salivarius	S. progenes

* A postoperative rise in temperature and hemorrhage were present twenty-four hours after operation.

organisms isolated from the blood were culturally identical with those found in the tonsil. In two cases only one strain was present in each instance; in one, three strains were found in both tonsil and postoperative blood culture. In the fourth case, that of an adult, three strains, two alpha and one beta, were isolated from the tonsil. From the blood, an alpha and one beta strain were isolated, but two of these were of different types from the alpha and beta strains found in the tonsil. Table 2 shows these relationships.

This report is presented without comment at this time. The results have seemed of sufficient interest to justify publication, without waiting for the further work which is in progress. It is hoped that a much larger series of cases will give data on which to base conclusions as to the relationship of tonsillectomy and rheumatic conditions of the heart, especially in children.

11. Rubin, M. I.; Epstein, I. M., and Werner, M.: Blood Cultures After Tonsillectomy, Am. J. Dis. Child. **38**:728 (Oct.) 1929.

12. Schwarz, H., and Frisch, I. A.: Blood Cultures After Tonsillectomy, Am. J. Dis. Child. **38**:1282 (Dec.) 1929.

SUMMARY

1. Forty-three per cent of the streptococci isolated from the interior surface of excised tonsils were *S. pyogenes*, 29 per cent, *S. infrequens* and 14 per cent, *S. anginosus*. The beta streptococci, *S. mitis*, *S. ignavus* and *S. fecalis*, constituted less than 1 per cent of all isolations.

2. *B. fusiformis* was present in 36 per cent of all cases.

3. Sixty-four blood cultures were taken two hours after tonsillectomy.

4. Streptococci were present in 6 per cent of these cultures. Mixed growth of streptococci and staphylococci, diphtheroid bacilli and a gram-negative bacillus were also found.

5. In one case two strains of streptococcus that had not been found in the tonsil appeared in the blood.

THE INFLUENCE OF EXCESSIVE MILK FEEDING ON GASTRIC MOTILITY AND ITS RELATION TO CHRONIC ANOREXIA *

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There has been widespread propaganda for extensive use of milk in the child's dietary. Its availability and simplicity of use, its acceptability to the child and its conceded excellence as a food have all contributed to further this propaganda. Numerous investigations with school children seem to point conclusively to the nutritional value of milk. An extensive investigation of this kind was carried out by Orr [1] and by Leighton and Clark [2] under the direction of the Scottish Board of Health. Since the production of milk and milk products is a national resource, it has an economic appeal.

Nutrition experts like McCollum and Simmonds,[3] Sherman,[4] Rose,[5] and Lusk [6] are ardent advocates of liberal amounts of milk in the diet, particularly in the diet of the growing child. Milk meets most of the requirements of a balanced diet, and McCollum and Simmonds [3] refer to it as "the most satisfactory single article of food consumed by man." They add, however, that "it is not a complete food when taken over a long period as the sole source of nutriment."

Definite ill effects from excessive milk feeding have been described. The German term "Milchnährschaden," popularized particularly by Czerny,[7] denotes a train of symptoms alleged to result from excess milk consumption in infants and in older children. Contrary to the opinion and dictum of students of nutrition who base their conclusions largely on

* Submitted for publication, Aug. 21, 1930.

* From the Institute of Child Welfare and the Department of Pediatrics, University of Minnesota.

1. Orr, J. B.: Influence of Amount of Milk Consumed on Rate of Growth of School Children: Preliminary Report, Brit. M. J. 1:140, 1928.

2. Leighton, G., and Clark, M.: Milk Consumption and the Growth of School Children, Brit. M. J. 1:23, 1929.

3. McCollum, E. V., and Simmonds, N. C.: The Newer Knowledge of Nutrition, ed. 3, New York, The Macmillan Company, 1925.

4. Sherman, H. C.: Chemistry of Food and Nutrition, ed. 3, New York, The Macmillan Company, 1927.

5. Rose, M. S.: How to Meet the Problem of the Delicate Child, Nation's Health 5:777, 1923.

6. Lusk, G.: Science of Nutrition, Philadelphia, W. B. Saunders Company, 1923.

7. Czerny, A., and Keller, A.: Ernährungstörungen und Ernährungstherapie, Leipzig, Franz Deuticke, 1917, vol. 2.

laboratory and animal experiments, many pediatricians of large clinical experience are doubtful of the value of a considerable amount of milk in the diet of the child. They feel that it is an important contributory factor in the causation or development of chronic anorexia.

In view of the widespread prevalence of chronic anorexia among children, the suggestion by Dr. Schlutz to determine, if possible, whether excessive milk consumption leads to chronic anorexia, possibly by affecting gastric motility, was welcomed.

A review of the literature yields little information regarding the influence of excess milk intake on gastric motility. LeWald [8] stated that he and Kerley, after studying several cases of dilatation and ptosis of the stomach, reached the conclusion that overfeeding, especially with milk, is an important etiologic factor. He stated further that limitation of fluids, particularly of milk, leads to improvement. Other authors (Wilson, Dickson and Singleton [9] and Ladd [10]) considered moderate distention of the stomach favorable for rapid evacuation.

The literature on the influence of nonexcessive amounts of milk on gastric motility is also rather scanty. Carlson [11] reported that in one instance the introduction of 10 cc. of milk into the intestine of a dog caused gastric inhibition of thirty minutes' duration, a longer period of inhibition than that caused by any other substance he used. Taylor [12] reported inhibition of gastric motility following the introduction of 20 cc. of milk or water into the stomach of infants. According to Carlson,[11] the average length of time elapsing between nursing and the onset of gastric hunger contractions in infants, from 24 hours to 4 weeks old, is two hours and forty minutes. Taylor,[12] stressing gain in weight and a knowledge of sufficient intake of food, stated that hunger develops in infants less than 2 weeks old, on the average of two hours and fifty minutes after the intake of food. He pointed out that in older infants the length of time necessary for the development of hunger is not entirely dependent on the rate of gastric evacuation, but that it depends partly on the form of nourishment, being shortest with food "which least satisfies the infant's tissue need" or "which is poorly tolerated," for instance, a high fat and low carbohydrate mixture.

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8. LeWald, in discussion on Van Der Bogert: The Limitations of Milk in the Diet of the Older Child, Albany M. Ann. **42**:145, 1921.

9. Wilson, M. J.; Dickson, W. H., and Singleton, C.: Rate of Evacuation of Various Foods from the Normal Stomach: A Preliminary Communication, Arch. Int. Med. **44**:787 (Dec.) 1929.

10. Ladd, M.: Gastric Motility in Infants as Shown by the Roentgen Ray, Am. J. Dis. Child. **5**:345 (May) 1913.

11. Carlson, A. J.: The Control of Hunger in Health and Disease, Chicago, University of Chicago Press, 1916.

12. Taylor, R.: Hunger in the Infant, Am. J. Dis. Child. **14**:233 (Oct.) 1917.

Most reports regarding the influence of milk on gastric motility concern the emptying time of the stomach for milk. Carlson [13] stated that his observations on the emptying time of the infant's stomach (two hours and forty minutes) confirmed the roentgen observations of Pisek and LeWald, Czerny, Leo and others that the child's stomach empties itself in from one and one-half to three hours. Murlin [13] stated that the average emptying time of the stomach of a child on an exclusive milk diet is from one and one-half to two hours for a bismuth meal of milk. He stated that doubling the amount of milk prolongs the emptying time but slightly. Bessau, Rosenbaum and Leichtentritt,[14] however, ascribed considerable importance to the amount. Employing the fluoroscope and contrast medium in their studies, they found that as long as the amount was less than the nutritional requirement, the stomach emptied itself rapidly. If the amount met the nutritional requirement, and more particularly, if it overburdened the gastro-intestinal tract, differences depending on the quality of the milk became evident. They reported that variations are common and that they are the rule in neuropathic infants. Their work seems to indicate that the relatively high protein content of cow's milk accounts for the difference between the time of sojourn of human and cow's milk in the stomach. They considered fat also to retard gastric evacuation. Ladd [15] likewise contended that protein in the coagulable form is the most important factor in delaying emptying of the stomach. His observations are to the effect that while mixtures rich in fat and fat-free mixtures retard gastric evacuation, a moderate amount of fat is favorable. Tobler [16] and Tobler and Bogen [17] called attention to the importance of fat in the duration of gastric digestion. In agreement with the observations of Murlin,[13] these authors stated that the duration of gastric digestion of milk is not directly proportional to the amount, being relatively shorter for larger quantities.

Reports concerning the rôle of milk in excessive or nonexcessive amounts in chronic anorexia are rather few. Schlutz [18] is emphatic in

13. Murlin, J. R., in Abt, I. A.: Pediatrics, Philadelphia, W. B. Saunders Company, 1923, vol. 1.

14. Bessau, G.; Rosenbaum, S., and Leichtentritt, B.: Nährung und Magenverweildauer, Jahrb. f. Kinderh. **95**:123, 1921.

15. Ladd, M.: The Influence of Variations of Diet upon Gastric Motility in Infants, Arch. Pediat. **30**:740, 1913.

16. Tobler, L.: Ueber die Verdauung der Milch im Magen, Ergebn. d. inn. Med. u. Kinderh. **1**:495, 1908.

17. Tobler, L., and Bogen, H.: Ueber die Dauer der Magenverdauung der Milch und ihre Beeinflussung durch verschiedene Faktoren, Monatschr. f. Kinderh. **7**:12, 1908.

18. Schlutz, F. W.: The Problem of Chronic Anorexia in Childhood, J. A. M. A. **94**:73 (Jan.) 1930.

his opinion that ingestion of large quantities of milk is unfavorable for the child's appetite. Chaney,[19] while conceding a favorable influence of milk on school children, spoke of a satiating effect of milk and its retarding influence on the appetite. She stated that "in many instances a glass of milk taken between meals or at the beginning of a meal will cause lack of appetite." Schoedel[20] and Greenwald[21] spoke of the satisfying properties of milk and the consequent lack of desire for other foods. Kerley[22] advised against overfeeding with milk, saying that "the use of large quantities of milk interferes with the appetite for vegetables and cereal." Thus one of the shortcomings of milk, namely, its bulk, becomes manifest. Although amounts of milk sufficient to satisfy hunger may be ingested, the intake of food is likely to be inadequate, and undernutrition will result. As the result of inadequate intake of other foods, deficiencies of milk having a decided bearing on appetite are likely to become manifest.

It is commonly conceded that if milk is ingested in excessive amounts, a type of anemia known as alimentary anemia results. Czerny[8] stated that it may prove fatal in advanced cases of "Milchnährschaden." Whipple and Robscheit-Robbins,[23] working on experimental anemias in dogs, found milk "conspicuously inadequate in hemoglobin producing ingredients." Carlson[11] stated that chronic anemias, as far as they influence hunger, are usually associated with a decrease or absence of hunger and appetite. Bartlett[24] contended that anemia plays a definite rôle in anorexia.

A further deficiency of milk which may result in the production of chronic anorexia if milk is taken in excessive amounts, is its vitamin deficiency. Chaney[19] called attention to the fact that "it has been forcefully demonstrated that all milk is not of equal food value since its vitamin content is altered by the fodder of the cow and also by the application of heat." Of particular interest is a vitamin B deficiency because of its retarding influence on appetite and growth. Sure[25] feed-

19. Chaney, M. S.: A Comparison of the Value of Milk and Oranges as Supplementary Lunch for Underweight Children, Am. J. Dis. Child. **26**:337 (Oct.) 1923.

20. Schoedel, J. C.: Art und Umfang regelmässigen Milchgenusses im Kindesalter, München. med. Wchnschr. **74**:1367, 1927.

21. Greenwald, H. M.: Anorexia Nervosa, Am. Med. **34**:875, 1928.

22. Kerley, in discussion on Van Der Bogert, F.: Albany M. Ann. **42**:145, 1921.

23. Whipple, G. H., and Robscheit-Robbins: Influence of Dairy Products on Hemoglobin Production, Am. J. Physiol. **79**:280, 1927.

24. Bartlett, W. M.: Analysis of Anorexia, Am. J. Dis. Child. **35**:26 (Jan.) 1928.

25. Sure, B.: A Detailed Study of the Rôle of Vitamin B in Anorexia in the Albino Rat, J. Nutrition **1**:49, 1928.

ing albino rats a diet free from vitamin B, found that they refused food by about the tenth day, and he concluded that vitamin B deficiency is a determining factor in the development of anorexia. Cowgill, Deuel, Plummer and Messer,[26] who studied the relation of vitamin B deficiency to gastric motility in dogs, found no marked change in gastric hunger contractions in mild cases of vitamin B deficiency with partial loss of appetite. In advanced cases of vitamin B deficiency, marked decrease of gastric motility and atony was noted. On vitamin B therepy, the appetite of the animals returned more promptly than did the normal gastric motility. They suggested that maintenance of gastric tone by vitamin B may be a factor in normal appetite. Never's [27] work indicates that defective absorption accounts in large part for prolongation of the emptying time of the stomach and the intestines in vitamin B deficiency.

EXPERIMENTAL WORK

Studies on gastric motility and gastric analyses together with clinical observations were made before and after a milk diet. Studies on gastric motility were also made after ingestion of milk and compared with those made without milk having been ingested.

Carlson and his co-workers [11] confirmed the observations of Canon and Washburn [28] that in normal persons strong hunger contractions give rise to the hunger sensation. They [11] found that the strength of the contraction corresponds fairly well to the intensity of the hunger sensation.

The balloon method perfected by Carlson and his collaborators [11] yields a graphic representation of intragastric pressure variations caused by gastric contractions. Considering the contentions of various observers as brought out by Rupp and Schlutz,[29] it is, indeed, surprising that results are as uniform and consistent as they are. A description by Carlson [11] of a typical record in the adult is briefly about as follows: Periods of motor activity ("hunger periods" composed of "hunger contractions") alternate with periods of relative quiescence. In some instances, the climax of a contraction period is characterized by a period of incomplete tetany on which are superimposed rapidly successive short contractions. Contraction periods vary from periods of weak contractions to periods of nearly continuous tetany. In the same persons variations are much less pronounced. Carlson [11] reported that the gastric motor activity in the infant is similar to that in the adult, but that contraction periods are more frequent in the infant. Taylor's observations [12] are much the same. Rupp and Schlutz [29] concluded that the

26. Cowgill, G. R.; Deuel, H. J., Jr.; Plummer, N., and Messer, F. C.: Studies in the Physiology of Vitamins: IV. Vitamin B in Relation to Gastric Motility, Am. J. Physiol. **77**:389, 1926.

27. Never, H. E.: Avitaminose und Verdauungsorgane, Arch. f. d. ges. Physiol. **219**:559, 1928.

28. Cannon, W. B., and Washburn, A. L.: An Explanation of Hunger, Am. J. Physiol. **29**:441, 1912.

29. Rupp, A., and Schlutz, F. W.: Motility of the Empty Stomach in Normal and in Malnourished Asthenic Children, Am. J. Dis. Child. **39**:241 (Feb.) 1930.

intensity of the child's gastric motor activity is intermediate between that of the infant and that of the adult.

Children older than 8 years were chosen for this study. The difficulty encountered with infants and very young children prompted abandonment of work with this age group. New-born infants usually sleep through the greater part of the procedure and cause but little difficulty. Older infants, however, cause considerable difficulty with crying; at least, they do if the period of starvation exceeds from six to eight hours. A strong hunger contraction awakens the infant rather readily and causes crying, which interdicts a satisfactory tracing. Chloral by rectum seems of definite value in that it induces sleep from which the infant is not readily aroused and in that it does not apparently interfere with normal gastric motor activity. One tracing obtained under chloral hypnosis showed vigorous gastric activity, many of the contractions reaching a height of from 10 to 11 cm. Children from 2 to 5 years old cause still greater difficulty. Lack of understanding induces them to adopt an attitude of defense and negativism. Although considerable suasion was necessary at times, the older children usually objected little to taking the balloon and tube. The first tracing was as a rule of no value as an indication of gastric motility. Apprehension, anxiety, fear, etc., were no doubt

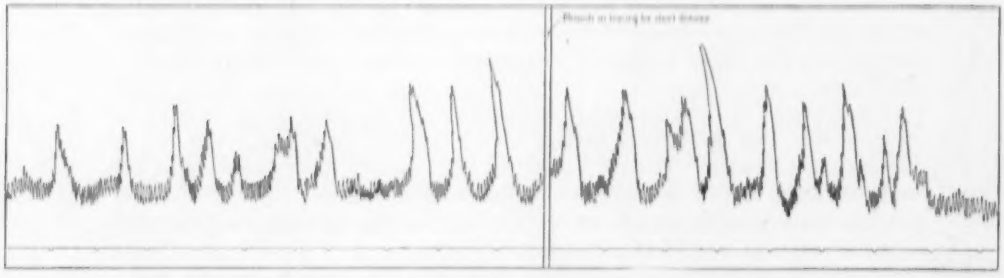

Chart 1.—Clara A., the asthenic type. Continuous record of contraction period ending without incomplete tetany.

inhibiting factors. Carlson [11] has shown that emotions may have a profound inhibitory influence on gastric motor activity. Several tracings were usually necessary to gain a fair knowledge of the subject's gastric motility. The tracings were continued for about one and one-half to two and one-half hours at a time. The procedure usually became irksome for the child before the end of that length of time.

Children in the Pediatric Department at the University Hospital were used as subjects. Since Carlson [11] reported that infections, fevers, anemia, cachexia, etc., may effect gastric motility, it was obviously important that children as nearly normal as possible be selected. Further, a very emotional child or one who disliked milk could not be used. These restrictions limited sharply the number of cases available for study.

Studies on gastric motility by the balloon method were made on eleven children before and after a milk diet which was continued as a rule for from seven to ten days. In a few instances, it was continued for two weeks. The milk diet was exclusive except in a few instances in which small amounts of other foods were taken. Milk was given the children whenever it was desired. Usually the largest amounts were taken at regular meal time. It was necessary to take two or more tracings both before and after the milk diet in most instances.

In four instances the emptying time of the stomach for a suspension of barium sulphate in 8 ounces of whole milk was studied fluoroscopically before and after the milk diet.

Gastric analysis in conjunction with motility studies was considered of interest first, because of the possible relation between gastric motor and secretory activity and second, to determine whether the high buffer value of milk would reduce the secretory function of the stomach. A test meal consisting of two small slices, about from 15 to 20 Gm. of zwieback, crushed and mixed with hot water to the consistency of thick cooked cereal, together with 6 ounces (later 5 ounces) of water was used, mainly because of its palatability. Forty-five minutes after the child had begun to take the meal, the gastric contents were aspirated. The short period of time was chosen to obviate finding the stomach empty at the time of aspiration. The aspirated material was examined for free hydrochloric and total

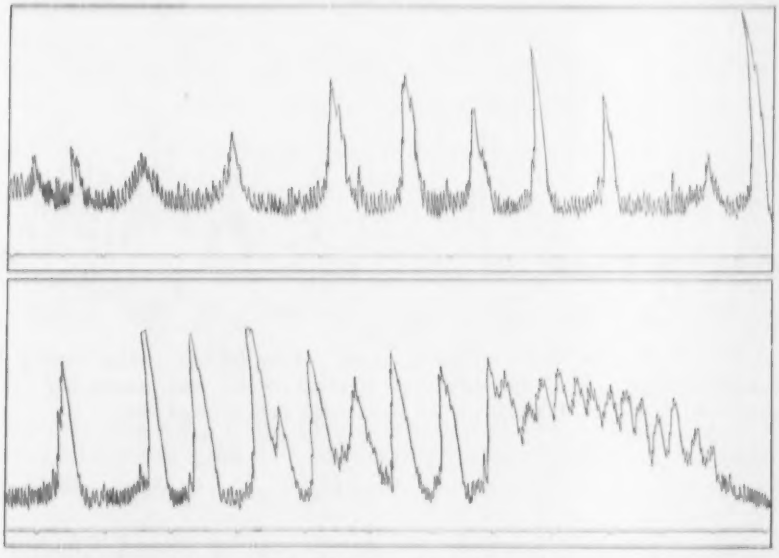

Chart 2.—Howard P. Continuous record of the contraction period ending in incomplete tetany.

acidity by Toepfer's [30] method. Whenever sufficient material was aspirated, total chlorides were determined by the method of Van Slyke.[31]

Clinical observations were made on the children on the milk diet. An approximate record of the daily intake of milk was kept, and changes in weight were observed. The urine was examined for acetone. Although milk is an antiketogenic food, ketosis might result from inadequate intake. Observation for the appearance of acetone was important clinically and because Carlson [11] reported that conditions characterized by acidosis augment hunger contractions. In a few instances, the stools were examined.

30. Todd, J. C.: Toepfer's Method in "Clinical Diagnosis by Laboratory Methods," ed. 5, Philadelphia, W. B. Saunders Company, 1928, p. 403.

31. McLean, Hugh: Van Slyke's Method in "Modern Views on Digestion and Gastric Disease," New York, Paul B. Hoeber, Inc., 1926, p. 128.

In eight cases tracings were started about three hours after the ingestion of 8 ounces of milk at 6 a. m. The object of this study was mainly to determine whether the presence of milk in the small intestine influences gastric motility. The study was considered especially desirable in view of the fact that Carlson [11] reported that in one instance milk introduced into the small intestine of a dog caused inhibition of gastric motor activity for twenty minutes, a longer period of inhibition than that caused by any other substance he used.

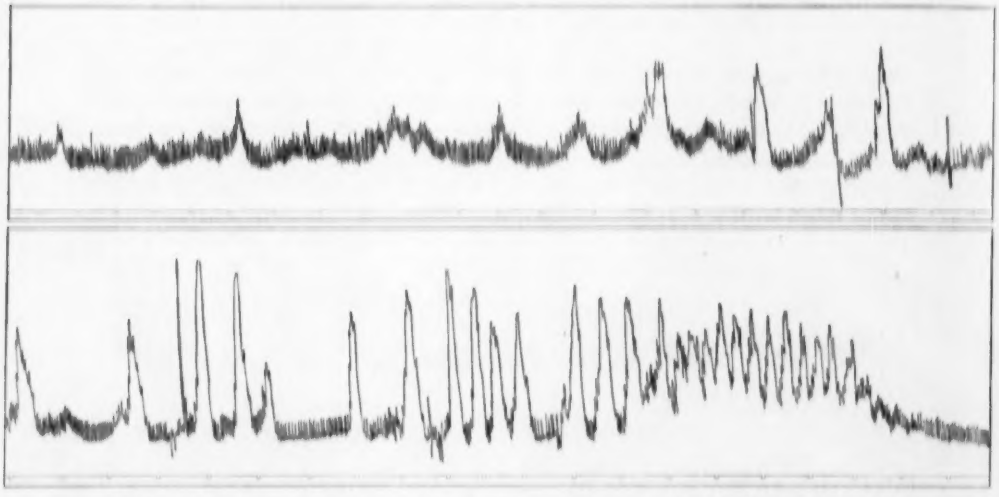

Chart 3.—Howard P. Continuous record of contraction period ending in incomplete tetany. Note the increase in intensity of the contractions and their occurrence at shorter intervals as the contraction period progresses.

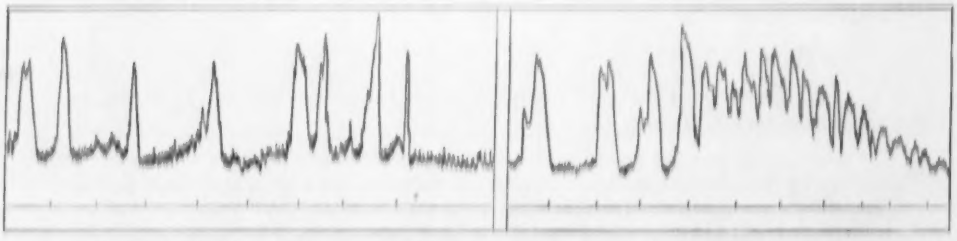

Chart 4.—Richard T. Termination of consecutive contraction periods, the first ending without incomplete tetany and the second ending in incomplete tetany.

RESULTS

On reviewing the gastric motility records, one is impressed by the great variability in different children and by considerable variability in the same child. This variability is evident in the retracings of records.

Some records showed typical contraction periods, ending in incomplete tetany; others showed absence of, or only mild, incomplete tetany.

As a rule, in agreement with the observations of Rupp and Schlutz,[10] the children of the asthenic habitus had less vigorous gastric motor activity than did others. In one child, however, whose habitus at least approached the asthenic type, the gastric activity was almost continuous. Periods of incomplete tetany were interspersed among strong contractions. In some instances the stomach is in a state of increased tone during most of the contraction period. Periods of quiescence are shorter in children than in the adult. The tonus rhythm, said by Carlson [11] always to be present during quiescence in the adult, was frequently not observed. It was most commonly absent immediately following the culmination of a contraction period. The sensitivity of the balloon to pressure variations during periods of absolute quiescence is attested to by the record of pressure variations due to respiration and pulse. This finding of absolute quiescence is in agreement with observations of Rupp and Schlutz.[10] Their conclusion that the gastric motor activity of the

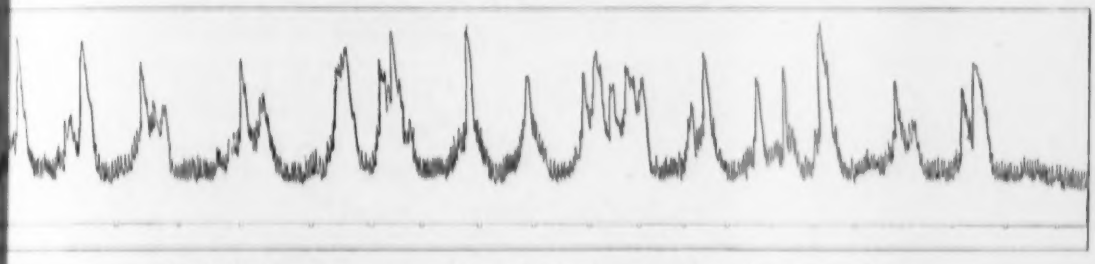

Chart 5.—Lloyd O. Contractions of about one minute duration and short periods of incomplete tetany in a contraction period which ended without incomplete tetany.

child is intermediate between that of the infant and that of the adult is also confirmed by this study.

In view of the fairly marked variability of tracings, it is evident that minute comparison of tracings is interdicted. In general, it seems that the gastric motor activity after the milk diet was about of the same magnitude as it was before the milk diet. It may be said without undue emphasis that possibly decreased motility was observed somewhat more frequently than was augmented motility after the milk diet.

The tracings taken after ingestion of milk showed practically as great gastric activity as did those taken without the ingestion of milk. Studies on the emptying time of the stomach before and after the milk diet were carried out in only four cases. The results which permit no definite conclusion are given in table 1.

The results of gastric analyses as will be seen in table 2 are essentially negative.

The clinical course of the children was quite uneventful. In a few cases, mild elevations of temperature were observed; in one case, nausea was present for a short period of time. Most of the children were cooperative in taking milk; in only one instance was it necessary to discontinue the milk diet because of noncooperation on the part of the child. Occasionally the complaint of being hungry for other food was regis-

TABLE 1.—*Emptying Time of Stomach Before and After Milk Diet*

	Before Milk Diet	After Milk Diet
Rosalie K.	Four hours and ten minutes after taking barium mixture, about 20 per cent gastric retention; five hours and five minutes after taking barium mixture, about 5 per cent gastric retention	Four hours and thirty minutes after taking barium mixture, no gastric retention
Mary S.	Four hours after taking barium mixture, no gastric retention; mixture in terminal ileum and cecum	Four hours and forty minutes after taking barium mixture, about 10 per cent gastric retention; most of mixture in terminal ileum
Richard K.	Four hours and ten minutes after taking barium mixture, less than 5 per cent gastric retention; most of meal in terminal ileum and cecum	Four hours and fifteen minutes after taking barium mixture, less than 5 per cent gastric retention; most of meal in cecum and ascending colon
Lois D.	Four hours after taking barium mixture, from 15 to 20 per cent gastric retention; most of meal in terminal ileum and cecum	Four hours and fifteen minutes after taking barium mixture, less than 5 per cent gastric retention; most of meal in terminal ileum; small amount in cecum

TABLE 2.—*Results of Gastric Analyses* *

	Before Milk Diet			After Milk Diet		
Name	Free Hydrochloric Acid	Total Acidity	Total Chlorides	Free Hydrochloric Acid	Total Acidity	Total Chlorides
Ethel R.	0.142	0.229	.....	0.136	0.281	.....
Ethel J.	0.171	0.302	0.216	0.153	0.262	0.211
Luella M.	0.158	0.204	0.199	0.124	0.197	0.194
John H.	0.118	0.226	.....	0.197	0.209	.....
Clara A.	0.125	0.118	0.280	0.245	0.313	0.276
Floyd O.	0.136	0.218	.....	0.120	0.249	.....
Fay T.	0.147	0.207	0.269	0.207	0.291	0.211
Mary Ann S.	0.219	0.302	0.302	0.182	0.262	0.300
Rosalie K.	0.160	0.219	0.261	0.158	0.167	0.244
Lois D.	0.116	0.182	0.198	0.182	0.238	0.208

* Acidity is expressed in terms of percentage; chlorides in milligrams per cent.

tered. The average daily intake of milk was from 2 to 3 quarts or more. In most cases, the caloric intake was inadequate. The weight remained practically stationary in a few cases. Some children lost weight, and one or two gained weight. The urine of one child showed a trace of acetone. The stools, which numbered about one a day, assumed a yellowish-gray color and a putty-like consistency. Definite decrease in appetite following the milk diet was not observed. Indeed, in some cases, the appetite seemed greater than before the milk diet.

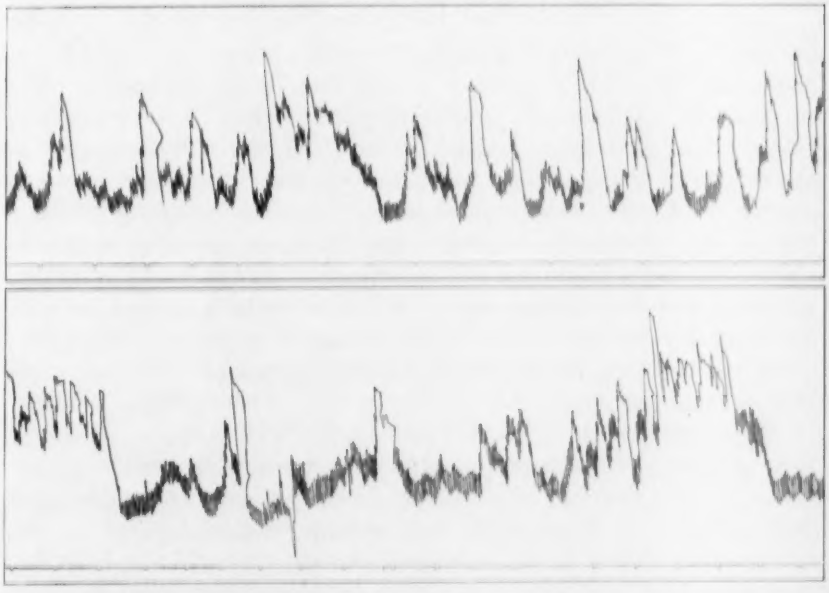

Chart 6.—Alice P. Continuous record of contraction period with frequent periods of incomplete tetany.

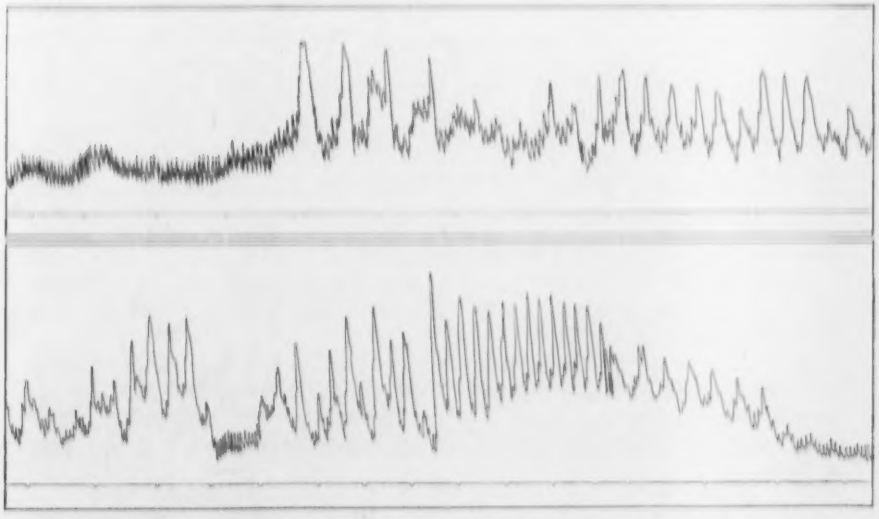

Chart 7.—John H. Continuous record of contraction period with almost continuous marked increase in tone.

COMMENT

Perhaps the variability in the gastric motility tracings can be accounted for to some extent by extraneous influences to which the child's gastric motor mechanism is apparently quite susceptible. The room in which the tracings were taken was not ideal. Loud noises and conversation immediately outside were frequent. Improvement in technic would probably yield more uniform and consistent results. A greater number of tracings on each child would permit more accurate comparison. Numerous tracings would, however, probably be incompatible with the temperament of most children. As has been pointed out, the good will and cooperation of the child is as necessary as it is desirable.

Further studies on the emptying time of the stomach may yield more definite information.

Since the studies of Hess [18] and Taylor [32] indicate that from the time of birth the stomach is capable of secreting full strength gastric juice and in view of the observations of Wright [33] and of Copeman and Hill,[34] it would be expected that the results for the children used in this study would be like those obtaining for adults. The free hydrochloric acid and combined acidity values recorded in the table compare favorably with the accepted normal values at forty-five minutes. The values for total chlorides agree fairly well with those of Copeman and Hill [34] at forty-five minutes.

The general well being of the children on the milk diet is in agreement with observations of Neff [35] on the adult.

CONCLUSIONS

Excessive milk feeding over a short period of time has little or no influence on gastric motility as recorded by the graphic method.

Continued over a short period of time, excessive milk feeding does not have an unfavorable influence on appetite.

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32. Taylor, R.: Hunger and Appetite Secretion of Gastric Juice in Infants' Stomachs, Am. J. Dis. Child **14**:266 (Oct.) 1917.

33. Wright, C. B.: Gastric Secretion, Gastro-Intestinal Motility and Position of the Stomach in a Group of 250 Children of the Lymanhurst School, Arch. Int. Med. **22**:435 (April) 1924.

34. Copeman, W. S. C., and Hill, N. G.: The Clinical Application of Total Chloride Estimations in the Fractional Test Meal with an Analysis of a Series of Fifty Normal Children, Quart. J. Med. **22**:33, 1928.

35. Neff, A.: Exclusive Milk and Gelatinated Milk Diets, M. J. & Rec. **128**: 67, 1928.

MALNUTRITION IN CHILDREN

AN ATTEMPT AT STANDARDIZATION OF A DIETARY *

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NEWARK, N. J.

Statistics regarding the incidence of malnutrition compiled by various authorities indicate that about one-third of the children of this nation are nutritionally below par. Wood [1] estimated that from 15 to 25 per cent of the school children are undernourished. Perlman [2] stated that in a recent survey conducted throughout the United States there were found 5,000,000 cases of malnutrition in children—almost one-fifth of the entire number of school children in the country. That the people of the United States as a nation have been neglectful of their greatest asset—the children—has been more and more recognized in recent years. Roberts [3] expressed her opinion well when she said: "We must admit that we have little reason as a nation to be conceited over the stock we are producing." She added: "It is true, moreover, that our standard of nutrition is higher than that of some other countries, though poorer than many." Statements such as these make the problem appear worthy of serious consideration and effort. So important does the problem of child welfare and protection seem to the government that some months ago President Hoover at a White House conference initiated an investigation of the present situation. One of the larger committees was charged, and is active, with the study of child nutrition.

Much investigation has been done, especially during the last decade, in an attempt to establish a standard dietary for children suffering from malnutrition. I have confined myself to this phase of the problem and have devised a dietary that is a decided departure from the usual dietaries employed in this condition. This paper is a discussion of an experiment conducted on a group of malnourished children who were put on this special dietary to test its nutritional value.

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* Read before the Pediatric Section of the Medical Society of the state of New Jersey at the meeting in Atlantic City, June 12, 1930.

* This study was made possible by an appropriation from the Research Fund of the Beth Israel Hospital, Newark, N. J.

1. Wood, T. D.: War's Emphasis on Health Education, New York Times, April 14, 1918.

2. Perlman, H. H.: A Study of Malnutrition in Children, M. J. & Rec. 130:152 (Aug. 7) 1929.

3. Roberts, L. J.: Nutrition Work with Children, Chicago, The University of Chicago Press, 1927, p. 7.

RELATION OF DISEASE TO MALNUTRITION

In dealing with malnutrition, one must not overemphasize the importance of diet to the neglect of other factors. Nevertheless, in a considerable proportion of undernourished children a cause for the nutritional state cannot be detected. It is especially in this type of case that the outstanding method of correcting the condition is the dietary treatment.

While it is not the primary object in this paper to enter into a discussion of the relation between disease and malnutrition, stress must be placed on the fact that, if a thorough enough study (including painstaking physical examination, laboratory tests of the blood, urine and stools, determination of the metabolic rate, and ophthalmoscopic and roentgenologic examinations) of the children suffering from malnutrition were made, the great majority would show a disease or defect somewhere in the body responsible for the condition. This view of the relationship between disease and malnutrition is borne out by the difficulty that I had in selecting a group of disease-free children suitable for the experiment to be conducted. I was offered approximately 200 underweight children from which to select a group for the experiment. Some were excluded because roentgenologic examination of the chest showed active tuberculosis; 4 had a 4-plus Wassermann reaction; some had rheumatic carditis; some were suffering from intestinal parasites, others from obvious endocrine dysfunction and many from badly diseased tonsils, carious teeth, nephritis, pyuria, vulvovaginitis, chronic otitis media, tracheobronchial adenopathy or paranasal sinus disease, so that by the time I had examined the entire group there were only 56 children left who I felt reasonably sure were not suffering from any disease or from any defect and on whom the experiment could be conducted.

DEVELOPMENT OF A NEW DIETARY IN MALNUTRITION

During the course of clinical observation, an attempt was made to trace back the type of diets that yielded the healthiest looking children, and contrariwise, the type that yielded children in a state of undernutrition. It appeared convincing that those children who were excellent examples of well nourished persons were the ones who consumed ample quantities of milk, whole grain cereal products, an abundance of fresh vegetables and much fresh fruits, meat not being a prominent article of the diet; whereas those who composed the group of malnourished ones, consumed large quantities of flesh foods and comparatively little milk, little or no whole grain cereal products, and fresh fruits and fresh vegetables sparingly. Further thought and observation seemed to verify this impression.

Malnutrition today is comparatively rare in infants; it is chiefly a condition of older children. This would indicate that the dietary changes made during the transition into childhood are not entirely successful. In the course of discussion with many parents, the fact was emphasized that until 2 years of age their children were in excellent health, but after this period a state of malnutrition gradually developed. It was elicited that radical changes had taken place in the dietary, flesh foods being introduced with partial or complete exclusion of milk, whole grain cereals, fresh fruits and fresh vegetables.

While in the older age groups many children coming under observation who were splendid looking specimens had been given meat since infancy, in nearly all these cases careful questioning revealed the fact that it was used so sparingly and so infrequently that it could not be responsible for the excellent physical development.

Many pediatricians, I am sure, have seen fine examples of physical development in children who have persistently refused to eat meat because of a natural dislike for flesh foods.

The vegetarians bring up their children on meatless diets. It has been my privilege to examine a large group of these children. While hitherto I had considered the vegetarians an erratic group, repeated observations showed their children to have such splendid posture, firm musculature, high color, excellent teeth, glossy hair, good layer of subcutaneous fat, bright eyes and high degree of energy that I was forced to give the matter of a meatless diet serious consideration and to experiment along this line.

I have had several patients in my practice who did not gain any appreciable weight over long periods of time, who almost instantly began to gain weight, when put on the type of meatless diet as advocated in this paper, and reached their normal weight in about two months. Moreover, in the chart showing the growth curves in the experiment described in later paragraphs, it will be noted that the children on the experimental diet also made astonishing gains in the first month.

Many authorities especially interested in the nutrition of children are opposed to meat, notably Rose,[4] who stated: "With the exception of liver, meat is too poor in growth-producing properties, and too stimulating to be given a place of any prominence in a child's diet. It must never be allowed to displace milk and vegetables." McCollum [5] said, "Lactovegetarianism when the diet is properly planned is the most highly satisfactory plan which can be adopted in the nutrition of man."

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4. Rose, Mary Swartz: The Foundations of Nutrition, New York, The Macmillan Company, 1927, p. 402.

5. McCollum, quoted by Abt, I. A.: Pediatrics, Philadelphia, W. B. Saunders Company, 1923, p. 933.

Pearson and Wyllie [6] made this statement: "While it is certain that the products of animals, milk, cheese and eggs, in suitable amounts, are natural foods and of great advantage to the human body, the necessity or the value of meat-eating is, to our minds, still an open question." To quote further, "It is known, both in the case of adults and children living under ideal conditions, that a perfect state of health and development can be attained on a diet the protein part of which is entirely derived from vegetable sources." Carter, Howe and Mason [7] stated that they favor a meatless diet: "The use of meat in the form of beef, mutton, veal, fish, etc., is not desirable for young children."

DIETARY IN DETAIL

Illustrative examples of the diet are here given.

Breakfast, 7:30 A. M.

A fresh fruit, raw or cooked, or, in place of this, steamed dates or steamed figs.

A whole grain cereal or a whole grain cereal product, wheat, oats, corn, rice or buckwheat.

Glass of certified milk.

Breadstuff—whole wheat bread, whole wheat rolls, whole wheat muffins whole wheat biscuits, or whole wheat raisin bread or muffins.

Dinner, 12 Noon

A thick soup made of fresh vegetables only.

Blue plate consisting of: three green vegetables, one starchy vegetable and a vegetable-nut roast. The latter is made of cooked peas, soy beans or other legumes, several fresh ground raw vegetables, ground nuts and whole wheat flour shaped into an oblong mass, baked in an oven, served sliced and covered with one of several different sauces.

Whole wheat bread.

Dessert—usually this is a pudding made of a whole grain cereal, raisins, a fruit, maple sugar, whipped cream and shredded coconut.

or

Vegetable stew, consisting of ten or twelve fresh vegetables and one or two starchy vegetables, all cooked down to a thick consistency, to which yeast extract is added, giving it a meaty flavor.

Spaghetti made of whole wheat and served with tomato sauce.

Whole wheat bread.

Dessert—date pudding with fruit sauce.

Fruit juice drink.

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6. Pearson, W. J., and Wyllie, W. G.: Recent Advances in Diseases of Children, Philadelphia, P. Blakiston's Son & Company, 1928, p. 169.

7. Carter, H. S.; Howe, P. E., and Mason, H. H.: Nutrition and Clinical Dietetics, ed. 3, Philadelphia, Lea & Febiger, 1926, p. 132.

or

Lentil soup.

Blue plate consisting of: egg plant steak with tomato sauce, steamed sweet potato, creamed spinach, beets and asparagus.

Whole wheat bread with jam.

Dessert—chocolate layer cake made of whole wheat flour.

or

Blue plate consisting of: steamed fresh corn, beets, peas, creamed squash and whole grain rice with yeast gravy or tomato sauce.

Corn muffins.

Fruit salad made of fresh raw fruits with whipped cream.

or

Tomato soup.

Blue plate consisting of: spinach steak, steamed cabbage, steamed cauliflower, steamed carrots, whole grain rice or whole wheat spaghetti.

Rye bread.

Dessert—junket.

or

Blue plate consisting of: vegetable croquettes with cream sauce, fresh corn, steamed string beans, steamed squares of celery and stewed tomatoes.

Vegetable broth.

Whole wheat nut bread.

Dessert—stewed fresh pineapple with whipped cream.

3 P. M.

Milk.

Supper, 6 P. M.

Dish of cooked whole grain cereal with ground nuts.
Dish of creamed spinach or creamed steamed celery.
Whole wheat bread with cream cheese.
Glass of milk.
Ripe bananas or other raw fruit.

or

Blue plate consisting of: raw carrots shredded extremely fine, raw cabbage shredded extremely fine, a few thin slices of cucumber, a few thin slices of tomatoes, potato salad with eggless mayonnaise and beets (cooked) sliced very thin.

Cocoa.

Whole wheat bread with peanut butter.

Crullers made of whole wheat flour.

or

Shredded wheat or muffets.

Cole slaw or lettuce and tomato salad with eggless mayonnaise.

Glass of milk.

Vegetable gelatin containing fruit and nuts, served with whipped cream.

COMMENT ON EXPERIMENTAL DIETARY

The dietary consisted of about three fourths of a quart of certified milk and of many milk products. Whole grain cereal products were served three times a day, fresh vegetables twice a day, both raw and cooked being served, fresh fruits twice a day, and freshly ground nuts and large quantities of legumes to keep the protein intake high. Moreover, the legumes, being complete proteins, provided a good source of those amino-acids essential for growth.

No meat, poultry or fish was used in any form. No animal broths were given. Neither gelatin nor eggs were included. The purpose of

TABLE 1.—*Comparative Analyses of Diets Used*

Constituents of Diet	Comparative Accepted Requirements for Children	Analyses of Diets	
		Experimental Diet	Control Diet
Total calories	1,500-2,400	2,147	2,080
Protein calories	15+%	323 15%	406 19%
Fat calories	35+%	670 31%	803 41%
Carbohydrate calories	50—%	1,154 54%	838 40%
Calcium, Gm. per day	1	1.20	1.08
Magnesium, Gm. per day	...	0.76	0.80
Potassium, Gm. per day	...	3.18	1.87
Sodium, Gm. per day	...	1.91	1.88
Phosphorus, Gm. per day	1.5	1.85	1.19
Chloride, Gm. per day	...	3.08	3.01
Sulphur, Gm. per day	...	0.70	0.66
Iron, Gm. per day	0.015	0.13+	0.007
Excess base in terms of cc. normal solution	...	71.81	16.83
Vitamin A	+++	+++	+++
Vitamin B	+++	++++	+++
Vitamin C	+++	+++	++
Vitamin D	+++	+++	+++
Vitamin E	++	+++	++

Note: The mineral values are greater than here shown since an entire mineral analysis could not be obtained from the tables.

omitting eggs was to confine the animal protein of the dietary to milk alone.

There are certain factors that I desire to stress. The diet meets the caloric need and covers the requirements of fat, protein and carbohydrate for the age group. It is high in essential mineral content, contains the essential amino-acids, is rich in all the known vitamins, is decidedly prominent in alkaline ash foods and embraces all the "protective group" of foods. Table 1 shows the analysis of a representative diet in each group as compared with the accepted dietary requirements of children for this age group. The mineral values as shown in the table are lower than the actual content in the diet because it was not possible to obtain an entire mineral analysis of certain of the foodstuffs, such as Vegex, Wheatena, Ralston, etc.

By the use of certified milk and the avoidance of meat the diet is rendered obviously low in bacterial content. The reason for using so much whole wheat is because of (1) its ability to build up hemoglobin, (2) its richness in mineral content and (3) its richness in vitamins; (4) it is well known, too, that a diet of milk and whole wheat cereal with no other addition but a small amount of sodium chloride will support growth of experimental animals through as many as twenty-one generations, and that the last members of the family will be more vigorous, larger and stronger than the first generations. Experiments performed on animals by Rose, Vahlteich and Bloomfield [8] proved the value of whole wheat in producing an increase in hemoglobin. Morgan and Barry [9] pointed out the importance of whole cereal, particularly wheat and rice, as a possible source of the vitamin complex B (B+G). In a group of underweight children, these authors secured decided increases in weight and in height by the mere addition of wheat germ to the diet.

At the beginning of the experiment, an attempt was made to equalize the caloric intake of both groups and to weigh the foods, much as is done in the case of diabetic or ketogenic diets. This, however, was found to be highly impracticable. The appetites of the different children varied, and the same child's inclination varied on different days according to its disposition. Furthermore, it was felt that children should be given as much as they wanted, and then after several weeks of observation the average intakes could be weighed and measured. This plan was carried out. The procedure of ordering weighed and measured portions of foods for children is not practical or possible in daily practice.

All foods used were very fresh, no canned articles of food being employed. No white bread was served. The spaghetti used was prepared from whole wheat flour; the rice was unpolished; to the gravies, sauces and soups, an autolyzed extract of yeast was added, imparting a flavor resembling that of meat; cakes and puddings were made of whole grain cereal products; the mayonnaise was eggless; no ice cream was given, because of its high bacterial content. Brown sugar and maple sugar were used for the additional mineral and vitamins that they provided; only certified milk was served.

Extra care and precautions were taken in selecting and preparing the vegetables. Only very fresh vegetables were used, for their flavor is decidedly better. The vegetables were placed in parchment paper and steamed, because by this method of cooking they retain their entire

8. Rose, Mary Swartz; Vahlteich, E. M., and Bloomfield, E. L.: Influence of Whole Wheat upon Hemoglobin Regeneration in Albino Rats, Proc. Soc. Exper. Biol. & Med. **26**:322, 1929.

9. Morgan, A. F., and Barry, M. M.: Underweight Children: Increased Growth Secured through the Use of Wheat Germ, Am. J. Dis. Child. **39**:933 (May) 1930.

mineral content and also their flavor. The raw vegetables were always considered a treat by the children. They were made attractive by shredding them extremely fine by machine, and this was always done immediately before serving so that they would not become dried out. The various colors, particularly when the food was served on colored plates, appealed to the children.

Because the children had always had meat previously, it became necessary to devise substitutes that resembled meat, in both taste and appearance. This was easily accomplished by serving the foodstuffs as "roasts," "steaks," "croquettes," and "meat balls," covered with tasty sauces, the chief constituent of these substitutes being legumes.

In addition, varied and unusual dishes were devised, as vegetable broths, vegetable stews, cold creamed soups, vegetable pot-pourri, squash pancakes, buckwheat vegetable mixture, braised vegetables, vegetable turnovers, glacéd vegetables, cakes and cookies made of whole wheat flour, pudding of whole cereal grains combined with nuts, fruit and cream, vegetable gelatin desserts, chocolate pudding made of whole wheat flour instead of corn starch, and crullers made of whole wheat flour. The possibilities of substitutes and combinations are both interesting and unlimited.

A large variety of breadstuffs were used—whole wheat, whole wheat with nuts or raisins, whole wheat muffins, bran muffins, whole wheat rolls of all sorts, rye bread, corn bread, corn muffins and graham bread.

CONTROL DIET

The control group was given an average representative American dietary.

Breakfast

Fruit or fruit juice.
Eggs with bacon or a dish of cereal.
Milk or cocoa.
Bread and butter.

Dinner

Large portion of meat, poultry or fish.
One starchy vegetable.
One green vegetable.
Bread and butter.
Dessert—either gelatin pudding, cake, starchy pudding, custard or ice cream.

3 P. M.

Milk.

Supper

Dish of cereal, eggs or fish.
Bread and butter.
Milk.
Dessert—cookies, pudding, cake, ice cream or fruit.

The control group of children received the same quantity of milk as the experimental group, though the milk used was grade A instead of certified. The protein intake was comparatively high, for example, about 19 per cent of the total calories. Meat and eggs were given daily. Most of the bread and cereals used were not of the whole grain; vegetables and fruits were not urged on the children as with the experimental group, but they were served once a day and occasionally twice. No nuts were given. The desserts were mostly puddings, cake and ice cream, whereas with the experimental group the desserts were mostly fruits, and when puddings were given, they were always prepared of whole cereal grains combined with a fruit.

MANNER IN WHICH EXPERIMENT WAS CONDUCTED

Selection of Subjects.—The fifty children selected were divided into two groups as nearly like one another in age, sex, weight and height of the members as possible. There were twenty-six girls and twenty-four boys. The two groups

TABLE 2.—*Summary of Progress in Weight and Height*

	May	December	Gain
Total age for experimental group	236 yr. 9 mo.		
Total age for control group	234 yr. 9 mo.		
Total height for experimental group	1,207¼ in.	1,245⅝ in.	38⅛ in.
Total height for control group	1,208⅝ in.	1,239⅝ in.	31 in.
Total weight for experimental group	1,305¼ lb.	1,479¼ lb.	174 lb.
Total weight for control group	1,307⅝ lb.	1,439¼ lb.	131⅛ lb.
Overweight, experimental group	−92¼ lb.	−24⅝ lb.	67⅛ lb.
Overweight, control group	−87⅝ lb.	−49⅝ lb.	38 lb.

lived in identical environments at St. Mary's Orphanage under the care of Catholic Sisters. They were segregated only for meals; at other times, they attended the same classes and enjoyed the same play periods and facilities.

The subjects were then divided into pairs with the two members of each pair as nearly equivalent as possible, first consideration being given to height and weight, for, of the four factors involved, these two are much the most important in their bearing on one another and on the experiment in general. One child of each pairing was assigned to the control, and one to the experimental, group. By careful selection, it was possible to divide the boys and girls equally between the two groups and to have the two groups practically identical as to average age, weight and height (table 2). One group was then arbitrarily selected for the experiment and the other for the control.[10]

In estimating the normal weight in each case, the Baldwin-Wood tables were used. Weight was estimated for an age calculated to the nearest birthday, and

10. Four additional subjects (two in each group) were carried in case of any casualties. This was a fortunate provision, as during the course of the experiment one of the members of the control group was withdrawn from the orphanage. His partner was discarded from the experimental group, and two surplus subjects were substituted (nos. 15 and 40 in table 2).

for heights interpolated, when necessary, between the heights given in the table. The normal weight for each child was thus calculated to the nearest half pound.[11]

Physical Examination of the Children.—Each child was subjected to a thorough and careful physical examination, including observations of height, weight, facial expression, posture, muscle tone, condition of skin and lymph nodes, condition of hair, appearance of mucous membranes and skin turgor, examination of teeth and tonsils, physical examination of chest, size of spleen and liver, the taking of the blood pressure and ophthalmoscopic examination, and also the following: roentgenologic examination of chest and of long bones (this being done for future comparison at the end of the experiment), routine examination of the blood, Wassermann and Kahn tests of the blood, tuberculin test, routine examination of the urine and examination of stools for parasites.

Physical Capacity Test.—Physical power may be measured in a great variety of ways—by climbing ropes, running races, walking long distances, performing on gymnasium apparatus, heaving weights and like activities. Or it may be measured by the performance of those physical evolutions that are the least common denominators of the more complex movements of earning a livelihood. These least common denominators are ability to hold, lift and carry weights with the hands, arms and legs. The heavier the weight that can be lifted and carried, the greater is the power of the individual.

The actual tests[12] (lung capacity, strength of grip and ability to lift weights with the back, legs and arms) were most of those standardized for purposes of classifying pupils for physical education programs in public intermediate and secondary schools in the state of New York, namely:

1. Lung capacity, measured with a wet spirometer, in cubic inches.

2. Grip strength, right and left hand, measured with an elliptical manometer, in pounds.

3. Back strength and leg strength, measured with a back and leg dynamometer, in pounds.

4. Arm strength, measured by multiplying the subject's $\frac{\text{weight}}{10}$ by the number of times he pushes his body from the bent arm, to the straight arm, position, the hands resting on a stall bar bench, the body reclining at right angles to the arms when in the extended position. This measurement is recorded in points.

The score is: Lung capacity (cubic inches) + right and left grip (pounds) + back lift (pounds) + leg lift (pounds) + arm strength (points) = Strength Index.

Other Measurements.—An estimation was made of the intelligence quotient of each child. A photographic study was made according to Clough and Murlin's technic. Anthropometric measurements were made at the beginning and at the

11. In a few cases, the age of the child was known, but his birthday was not. In such instances, the initial normal weight was calculated on the basis of the age given at the time the experiment was started, and the final normal weight on the basis of a year's increase in age; that is, if a boy was 9 years old with no data as to birthday, he was considered 9 years old for the initial estimates and 10 years old for the final ones.

12. These tests are described in chapter 17 of "Tests and Measurement Programs in the Redirection of Physical Education" by Frederick Rand Rogers, published by the Bureau of Publications, Teachers College, Columbia University.

end of the experiment. Studies of nitrogen balance were carried out, as well as a comparative study of the effect of the experimental and control diets on the growth of two groups of rats.

RESULTS IN HEIGHT AND WEIGHT

Progress in Height.—In table 2 it is shown that the experimental groups as a whole gained 38½ inches (97.71 cm.), whereas the control group gained 31 inches (78.74 cm.), a percentage of 24 per cent in favor of the experimental group.

Progress in Weight.—As has been previously stated, the children of the control and those of the experimental groups were, at the start, of virtually equal average age, height and weight. Table 3 shows the detailed progress in height and weight of each child carried through the experiment for the period of six months.

Table 2 summarizes the progress of the two groups. The children of the experimental group (table 4) gained an average of 7 pounds (3,175 Gm.), whereas the children of the control group gained an average of 5.3 pounds (2,404 Gm.). The average experimental gain was thus 1.7 pounds (771 Gm.), or 32 per cent, greater than the average gain of the control group. The standard deviation of this difference is 0.58, that is, the 1.7 differential gain is 2.93 times its standard deviation. Statisticians consider that a difference which is 2.72 times as large as its standard deviation is a practically certain and statistically significant one. Thus, the last column in table 4 interprets the relationship between the obtained difference and its standard deviation, and indicates that there are only 16 chances in 10,000 that the 32 per cent superiority of the experimental group was accidental.

An important contribution to the study is provided by an analysis of the month-by-month weight accretions. Figure 1 is a graph of these data and traces the average monthly growth of each of the two groups. Of striking significance is the slightly greater than 3 pound (1,360.8 Gm.) gain made by the experimental group during the first month. This is more than 140 per cent greater than the gain of the control group for the same period, and is almost 50 per cent of the total experimental gain for the entire duration of the experiment. As will be seen, the advance of the experimental group in the first month is somewhat reduced in the next two months and is not again attained at any other time during the experiment. It will be remembered that the control group was 3.69 pounds (1,673.7 Gm.) underweight on an average at the beginning of the experiment, and in gaining over 3 pounds (1,360.8 Gm.) during the first month the children had virtually overcome their underweight condition. It is not surprising then that the experimental diet should have been relatively less effective during

TABLE 3.—*Detailed Progress in Height and Weight*

	Control												Experimental											
	May						December						May						December					
	Age			Ideal	Actual	Over-	Age			Ideal	Actual	Over-		Age			Ideal	Actual	Over-	Age			Ideal	Actual	Over-
No.	Yr.	Mo.	Height, In.	Wt., Lb.	Wt., Lb.	weight, Lb.	Yr.	Mo.	Height, In.	Wt., Lb.	Wt., Lb.	weight, Lb.	No.	Yr.	Mo.	Height, In.	Wt., Lb.	Wt., Lb.	weight, Lb.	Yr.	Mo.	Height, In.	Wt., Lb.	Wt., Lb.	weight, Lb.
1	9	6	49½	56½	49¾	— 6¾	10	1	51	61	55¾	— 5¾	26	10	8	49½	58½	48⅞	— 9⅝	11	3	51	63	59	— 4
2	7	6	46½	46	44¾	— 1¼	8	1	45⅝	47	45⅞	— 1⅛	27	7	8	47⅜	51	48⅜	— 2¼	8	3	48¾	54	53¼	— ⅝
3	12	2	57	82	82¾	⅝	12	9	58½	90	91	1	28	13	8	57	88	79½	— 8½	14	3	57¾	92	88	— 4
4	9	3	50½	59½	56	— 3½	9	10	51½	62½	59	— 3½	29	10	7	50	61	56¾	— 4¼	11	2	52	65	66¼	1¼
5	10	2	49¾	57	56	— 1	10	9	51	63	63	0	30	10	0	50	59	58½	— ½	10	7	51½	62½	61	— 1½
6	12	5	52	67	63¼	— 3¾	13	0	53½	72	68⅝	— 3⅜	31	10	6	52	64	60¼	— 3¾	11	1	53⅜	67	64½	— 2½
7	12	10	56½	82½	71¼	—11¼	13	5	58¼	89	80½	— 8½	32	12	4	54½	73	72½	— ¾	12	11	57	82	85	3
8	5	8	37	32	28	— 4	6	3	38⅝	35	32⅝	— 2⅜	33	5	3	36⅝	32	29½	— 2½	5	10	38⅜	35	33½	— 1½
9	8	2	43	41	37½	— 3½	8	9	44⅜	46	43½	— 2½	34	7	6	43⅜	43	38⅜	— 4¼	8	1	44⅜	46	44⅛	— 1⅜
10	8	6	44½	45	42	— 3	9	1	46	48	51	3	35	8	6	44½	45	41	— 4	9	1	47	50	51	1
11	7	10	42	39	38	— 1	8	5	43¼	42	45½	3½	36	7	5	42½	40	39½	— ½	8	0	44⅜	46	49	3
12	8	8	44½	45	42¼	— 2¾	5	3	45½	46½	46¾	— ¾	37	8	8	44⅜	46	44½	— 1½	9	3	47	50	50¼	¼
13	7	6	41	38	38	0	8	1	42¾	40	43½	3½	38	6	6	40½	37	37⅜	⅜	7	1	42½	40	45⅜	5⅜
14	9	11	51⅜	63	58	— 5	10	6	52½	65½	64	— 1½	39	9	5	51½	62½	58¼	— 4¼	10	0	52½	65½	67	1½
15	11	3	54¾	72	67½	— 4½	11	10	55	75	72⅝	— 2⅜	40	12	4	54¾	72	66¾	— 5¾	12	11	56	79	73⅝	— 6⅛
16	6	8	42	39	36	— 3	7	3	42¾	41	39⅝	— 1⅛	41	7	6	42	39	37	— 2	8	1	43½	41	41⅜	⅛
17	6	6	42⅝	41½	39½	— 2	7	1	44½	42½	40	— 2½	42	8	9	43¼	42	39	— 3	9	4	45½	47	46½	— ½
18	11	11	49	55	51	— 4	12	6	50¼	59	55¾	— 3¼	43	10	9	49	56	51¾	— 4¼	11	4	50½	62	56¾	— 5¼
19	5	9	42½	40	35	— 5	6	4	44	42	38½	— 3½	44	5	6	40½	37	33	— 4	6	1	41⅜	39	37	— 2
20	11	0	51½	62½	61¾	— ¾	11	7	53	68	67½	— ½	45	10	6	51	71	59½	— 11½	11	1	52½	66½	67	½
21	11	0	51	63	54½	— 8½	11	7	51½	66	59	— 7	46	9	3	51¼	62	57¼	— 4¾	10	10	52¾	66	63½	— 2½
22	11	6	52	65	63¾	1¾	12	1	54½	73	71½	— 1½	47	12	9	52⅝	70	66½	— 3⅜	13	4	55	74	70¾	— 3⅜
23	11	0	55⅜	77	74¼	— 2¾	13	7	56⅜	82	80¼	— ¾	48	12	4	55⅜	78	76	— 2	12	11	58	88	92¾	4¾
24	10	7	49⅜	55	52	— 3	11	2	50	58	57	— 1	49	8	7	49½	56½	51	— 5½	9	2	50	58	55¾	— 2¼
25	9	6	54½	72	62	—10	10	1	55	74	66	— 8	50	9	10	52	64	54¼	— 9¾	10	5	52¼	65	56¼	— 6⅞
Total	224	9	1,298⅜	1,395½	1,307¾	—87¾	249	4	1,239⅜	1,489	1,439¼	—49¾		236	9	1,267⅛	1,397½	1,305¼	—92¼	251	4	1,245⅝	1,504	1,479¼	—24¾
Average						—3.51						—1.99							—3.69						—0.99

The experimental group gained an average of 2.70 pounds in excess of the amount predictable on the basis of growth in age and height. The comparable control gain was 1.52 pounds, a difference of 1.18 pounds (average) in favor of the experimental group. The experimental gain (with age and height controlled) was 77 per cent greater than the control gain.

the succeeding months. The control group had a distinct advantage after the first month, since it was still more than 2.25 pounds (1,020.6 Gm.) underweight on an average, and, analogically, offered much less resistance to its diet.

Thus far, it would seem valid to conclude that the experimental diet is generally superior (undifferentiated for sex) to the control diet in improving the nutritional condition from the standpoints both of the rapidity with which results were achieved and of the permanency of these results.

TABLE 4.—*Average Gains in Weight (Pounds)*

	Average Gain, Lb.	Difference	Standard Deviation of the Difference	No. of Chances in 10,000 Difference Is Accidental
Experimental group.....	7.0	1.7	±0.58	16
Control group.....	5.3			

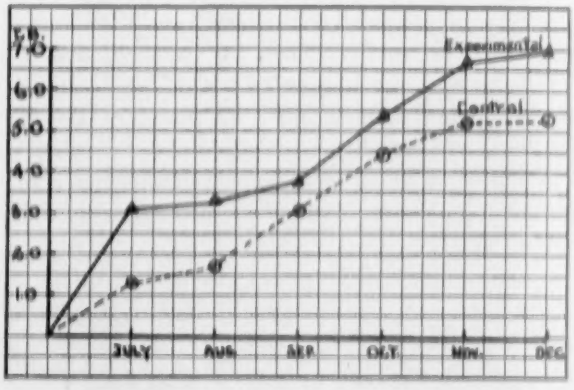

Fig. 1.—The average monthly accretions of weight shown by the experimental and control groups.

RESULTS OF ANTHROPOMETRIC STUDY

The object in making a more extensive study along anthropometric lines was to obtain comparable measurements, because the height-weight-age tables are considered very unsatisfactory by many authorities. To use the technic of the height-weight-age tables in the interpretation of weight gains is to expect that the person who gains most in height will gain most in weight. Weight bears an essential relationship to the total skeletal configuration of which height is only a single aspect. It is necessary to show that the components of the growth resulting from the maturation of congenital or developmental factors were equal before any direct comparisons can be made.

Composite measures of growth in height, chest breadth, chest depth and width of hips provide fairly reliable indexes of just those components of the total growth which are directly attributable to the maturation of hereditary factors. The technic of the height-weight-age tables is based on the assumption that height alone is an adequate index of the congenital factors. Yet, obviously, growth in height is not at all necessarily attended by growth in chest breadth, chest depth or width of the hips. Often the converse is true. The tall person is frequently the flat-chested or narrow-chested one. It is conceivable that the child who gains much in height will gain but little in weight, not because of any deficiency inherent in his diet, but because developmental factors reflected in relatively limited growth in the three other skeletal characteristics have made this small weight gain normal for him.

As was shown, the control and experimental groups were, at the start, of virtually equal average age, height and weight. Equality in these conditions alone, however, scarcely provides an adequate basis for the interpretation of the gains made over the period of experimentation. If, then, the weight gains of the children in the experimental and control groups are to be used as a basis for the evaluation of the relative efficacy of the experimental and control diets in improving the nutritional status, adequate allowance must be made for the developmental factors operating in each group, as expressed, not alone in gains in height, but in the gains in all four skeletal characteristics.[13] The residues in each case would then furnish the directly comparable measures that I was seeking.

Unfortunately, tables similar to the height-weight-age tables but at the same time taking into consideration the other skeletal measures are not available. However, it was possible to measure the children in the four skeletal characteristics, and to compare the groups in the gains made, so that a basis would be provided for the interpretation of the differential gains in weight. Accordingly, all the children were measured in height, breadth of chest, depth of chest and width of hips both at the beginning and at the end of the experiment. The gains were computed and converted according to statistical technic into standard measures. The standard measures have the virtue, since they are all expressed in the same units, of being additive, so that a single composite measure of all four structures is possible for each child.

13. The writer is indebted to Franzen for the conception of the skeletal characteristics as developmental determinants of weight. He has directed an exhaustive study of the relationships involved, which has been admirably reported in "Physical Measures of Growth and Nutrition," no. 2 of the School Health Research Monographs published by the American Child Health Association.

Table 5 is a record of the average gains in the standard deviations of the four skeletal characteristics made by the total experimental group, by the total control group and by each of the sex subgroups.

It will be noted at once that the composite gains of the total groups were almost equal, the control group with its gain of 0.38 being 0.05 of a standard deviation in advance of the experimental group. The difference is relatively insignificant, from which it may be inferred that developmental factors were operative to an equal extent in both groups. The logical conclusion follows that any difference in the weight gains between the two groups cannot be due to a differential facilitation by the maturation of congenital factors. On the other hand, a difference in the gains in weight under these conditions of equal skeletal growth must be a direct measure of a difference in the nutritional improvement

TABLE 5.—*Average Gains in the Standard Deviations* of the Four Skeletal Characteristics*

	Experimental Boys	Experimental Girls	Control Boys	Control Girls	Total Experimental Group	Total Control Group
Height	−0.67	0.06	−0.22	0.03	−0.24	−0.08
Chest breadth	0.77	0.47	0.78	0.50	0.59	0.62
Chest depth	0.75	0.52	0.50	0.48	0.61	0.49
Hip width	0.21	0.42	0.41	0.53	0.33	0.48
Composite average	0.27	0.37	0.37	0.38	0.33	0.38

* The standard deviation is a measure of variability of which the probable error is a derivative. The probable error is 0.6745 times the standard deviation.

attributable to dietary differentiation. If anything, a slightly greater reduction should be made from the gains in weight of the control group in view of its slightly greater gain in the developmental weight determinants.

The problem of determining the relative nutritional value of the two diets under consideration has thus been approached from a somewhat different angle. A study, too, has been made of the comparative gains in the girth of the upper arm, the girth of the calf and the amount of subcutaneous tissues over the biceps, with full allowance made in each case for age and sex factors and for the four skeletal characteristics. The methods underlying this study are too technical and involved for presentation here. The technics were developed under the direction of Dr. Franzen and are described in the monograph previously referred to. The inferences derived from this anthropometric study strongly corroborate the conclusion that the experimental group surpassed the control group in nutritional progress.

DIFFERENCES ACCORDING TO SEX SUBGROUPS

The data when analyzed into sex subgroups have produced results suggestive of an apparent dietary differentiation with relation to sex. Table 5 shows that the average composite gains in the four skeletal structures (height, chest breadth, chest depth and hip width) which index the congenital determinants of weight were equal for the girls of the experimental group and the girls of the control group. It follows that the weight gains of these two subgroups, in line with the foregoing discussion, are directly comparable. The control boys, however, gained more than the experimental boys in the skeletal characteristics by 0.10 of a standard deviation. This difference, again, is not great, but it does indicate that a proportionately larger component of weight gains for the experimental boys is to be attributed to the diet.

No attempt will be made to compare a group of boys with a group of girls. To make such comparisons would scarcely be justifiable, particularly in this experiment. Sex differences in activity and in other matters bearing on growth are too marked to permit such comparisons. Moreover, in this experiment the age range of the girls differed decidedly from that of the boys. However, growth-determining conditions were approximately equal as between the subgroups of the same sex, so that the results in the group of experimental girls are comparable with those in the group of control girls, as are those in the group of experimental boys with those in the group of control boys. The study of dietary differences, then, will be made only between groups of the same sex.

TABLE 6.—*Sex Difference Shown by Average Gains in Weight*

	Experimental	Control	Difference	Difference in per Cent
Boys	6.4	5.7	0.7	12.3
Girls	7.5	4.8	2.7	56.3

Table 6 records the average weight gains made by each of the sex subgroups under consideration and indicates that a large part of the superior gain made by the experimental group as a whole may be resolved into a still greater superior gain made by the experimental girls. Nevertheless, the experimental boys did make a greater gain than the control boys by 12.3 per cent. It should be remembered that this difference would have been somewhat larger had the skeletal gains been equal for both these groups. What stands out markedly is the greatly superior gain made by the experimental girls as compared with the control girls. The gain of the experimental girls was fully 56 per cent greater than that of the control girls, the difference being 2.7, or almost 3 pounds (1,007.7 Gm.).

Figure 2 traces the monthly weight accretions made by each of the sex subgroups. When it is considered that only those groups that are composed of children of the same sex are comparable, it will be seen that this graph presents corroborative evidence for the entire period of experimentation. One exception is worthy of consideration. At the end of the first month, the experimental boys had gained 1.6 pounds (725.7 Gm.) more than the control boys. This is a statistically significant difference. The experimental boys were 3.46 pounds (1,569.4 Gm.) underweight on an average at the beginning of the experiment, and in gaining at the beginning of the experiment and in gaining 3.58 pounds (1,623.8 Gm.) during the first month (figure 2) they had practically completely overcome the underweight condition. The boys on

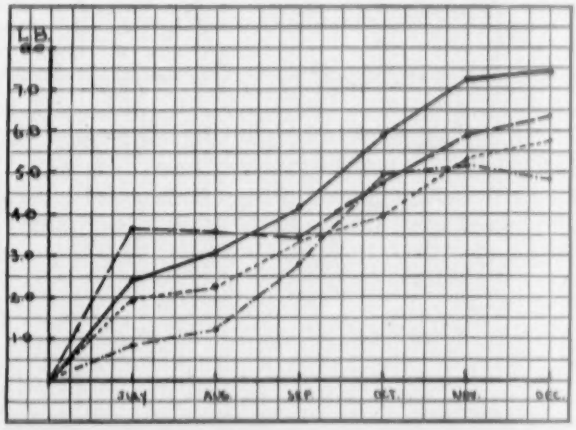

Fig. 2.—The average monthly gains in weight made by the sex subgroups. The girls of the experimental group are represented by the solid line; the girls of the control group, by the dot-dash line. The boys of the experimental group are represented by the long dash line; the boys of the control group, by the short dash line.

the control diet had yet a long way to go at the end of the first month to make up their underweight, so that the progress of their gains was much more regular hereafter.

HEMATOLOGIC DATA

Examinations of the blood in the children of both groups did not show any contrast in progress over the experimental period. It is interesting to note that both groups showed a corresponding seasonal variation in their hemoglobin percentages as indicated in figure 3, that is, a sharp rise in August and a gradual decline toward winter.

The average erythrocyte counts likewise do not show noteworthy variations. This is indicated graphically in figure 4.

RESULTS OF URINARY STUDIES

Several days prior to the termination of the experiment, qualitative and quantitative tests were made on the urines of ten boys of each group. The results are tabulated in table 7. The salient point brought out in the study is the reaction of the urine.

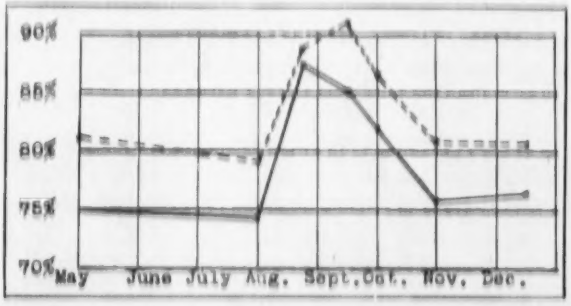

Fig. 3.—Curves of the hemoglobin percentage in the experimental group (solid line) and in the control group (broken line). Hemoglobin was estimated by the Newcomer method. Seventeen grams equals 100 per cent.

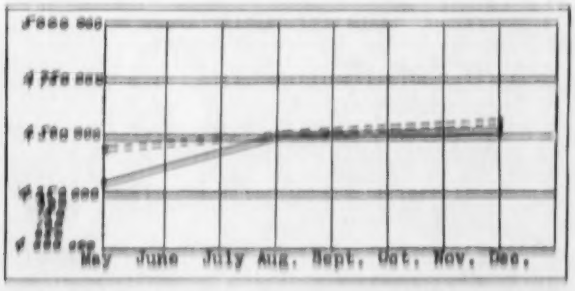

Fig. 4.—Curves of the red blood cell count in the experimental group (solid line) and in the control group (broken line).

The acidity is expressed in cubic centimeters of normal sodium hydrate required to neutralize the twenty-four hour specimen, Folin's standard method being used with phenolphthalein as an indicator. Although none of the specimens was alkaline or even neutral, it is seen that in no instance was more than 20 cc. of normal sodium hydrate required to neutralize the urine of a subject on the experimental diet, whereas seven of the ten urines from the subjects on the control diet

required more than 20 cc. Relatively, therefore, the acidity was higher in the urines of the children on the meat diet than in those of the children on the experimental diet.

Solid Output.—The children on the experimental diet eliminated, as a group, but 70 per cent as much solids as the group on the meat diet. This is summarized in table 8.

Thus, if the work of the kidneys is measured by the total output of solids, the greater output of solids by the children in the control group

TABLE 7.—*Results of Examinations of Urine*

Group	Total Urine, Cc.	Specific Gravity	Total Acid in Cc. N/NaOH	Indican	Ehrlich Diazo	Albumin	Sugar	Microscopic
Experimental								
1	470	1.038	16.00	0	0	0	0	0
2	410	1.018	10.66	0	0	0	0	0
3	580	1.036	16.24	0	0	0	0	0
4	280	1.024	14.28	0	0	0	0	0
5	500	1.024	19.00	0	0	0	0	0
6	480	1.022	12.96	0	0	0	0	0
7	850	1.018	19.55	0	0	0	0	0
8	600	1.024	18.00	0	0	0	0	0
9	670	1.016	11.39	0	0	0	0	0
10	480	1.022	9.6	0	0	0	0	0
Control								
1	490	1.018	17.15	0	0	0	0	0
2	420	1.024	11.76	+	0	0	0	0
3	940	1.022	27.20	0	0	0	0	0
4	940	1.020	25.38	T	0	0	0	0
5	760	1.020	20.52	0	0	0	0	0
6	580	1.020	16.24	0	0	0	0	0
7	1,100	1.016	27.40	0	0	0	0	0
8	1,110	1.018	26.64	0	0	0	0	0
9	800	1.022	20.80	T	0	0	0	0
10	950	1.016	23.75	T	0	0	0	0

TABLE 8.—*Urinary Output of Solids*

	Average Specific Gravity	Total Average, Cc.	Solid Output,* Gm.
Control group	1.0202	809	38.07
Experimental group	1.0232	558	27.82

* As computed by Häser's formula.

is an indication that those on the meat diet were subject to a greater degree of kidney activity than were those on the experimental diet.

When indican was found, it was present only to a slight degree and then only in the urine of those on the meat diet.

RESULTS OF PHYSICAL CAPACITY TESTS

The report of Dr. Frederick Rand Rogers on the results of the physical capacity tests is given in table 9, in abstract.

The normal strength index for children of the average age and weight of those employed in this experiment is between 375 and 400 points. Yet the index for these selected children averaged 450 points, indicating that their general physical powers exceeded by far those that would be secured from a random sampling of public school children. This was to be expected, since the children were carefully selected as free from disease and defect.

The control group, though equal to the experimental group in age, height and weight, was nevertheless 746 points, or 7.5 per cent, below the experimental group in strength, indicating that its physical powers were less well developed and therefore should have improved more rapidly even under ordinary conditions. The experimental group, however, gained 296 points more than the control group. Had the two groups been equal in strength at the beginning of the experiment,

TABLE 9.—*Strength Indexes—Gains or Losses*

Children	Groups	June	December	Difference
25	Experimental total	11,398	13,055	1,657
24	Control total	10,652	12,013	1,361
	Differences	746	1,042	+296
12	Experimental boys	4,459	4,766	807
12	Control boys	4,527	5,072	545
	Differences	−68	−306	−238
13	Experimental girls	6,939	8,289	1,350
13	Control girls	6,125	6,941	816
	Differences	814	1,348	+534

doubtless the superior gain of the experimental group would have been much greater. Seven per cent difference in physical powers for the same age and weight is great in terms of relative fitness.

When the scores of the boys and girls are separated, a real difference is revealed. The experimental group of boys gained 238 points less than the control group of boys, while the experimental group of girls gained 534 points more than the control group of girls.

RESULTS OF ROENTGEN STUDY OF BONES

Roentgenograms of the long bones of the extremities were made in June and December. At the end of the six months, comparative examinations made by Dr. Nathan Furst, director of the x-ray laboratories of the Beth Israel Hospital, Newark, showed an improvement in the osseous details in the bones of the children in the experimental group. There was an increase in the density of the bone in general, but particularly in the finely penciled lamellar structures. Several of the children responded unusually well in that the epiphyseal development appeared somewhat in advance of the expected progress for the period of the experiment. Furthermore, in a few cases there appeared to be

an improvement in the anemic condition of the children as judged by a decrease in the radioparency of the bone. The roentgenographic study of the bones of the children comprising the control group showed only the usual development expected over the experimental period.

RESULTS OF STUDIES OF STOOLS

Studies of the stools yielded most gratifying results. There was a sharp contrast between the two groups. The stools were examined once a month during the entire experiment, but the report given here covers a study made during the final week of the experiment. Whatever changes the experimental diet could produce in the stools would then be at their height.

The report as given by the Laboratories of the Beth Israel Hospital is as follows:

Physical Characteristics.—The stools of the experimental group were of a lighter average color than those of the control group. In the former, the color ranged from light brown to brown; in the latter, from brown to dark brown.

In both groups, when the stools were firm in consistency, little odor was evident. The control group frequently showed fluid and semifluid stools that were of a definitely foul odor. The experimental group rarely manifested such stools.

In size, the defecations of the experimental group were between 25 per cent and 50 per cent larger than those of the control group.

The experimental group had firmer and more well formed specimens on the average than did the control group. About 25 per cent of the stools of the control group were of a semifluid and fluid consistency. Mucus was plainly evident in several of the stools of the control group and rarely in those of the experimental group.

Bacteriologic Observations.—The apparent total number of bacteria in the stools was found to be about 20 per cent less in the experimental than in the control group.

An outstanding feature in this study was the sharp contrast of the two groups in the comparative numbers of viable putrefactive flora as typified in *Bacillus welchii*. Preliminary bacteriologic examination of the stools done in the earlier months had already indicated that there might be a decrease in the *B. welchii* content.

The litmus milk anaerobic method was used, the dilutions in sterile physiologic solution of sodium chloride being 1:10, 1:100, 1:1,000, 1:10,000 and 1:100,000. One cubic centimeter of each dilution was inoculated into the tubes of litmus milk, heated at 80 C. for twenty minutes to destroy all vegetative bacteria, and then incubated at 37 C. for eighteen hours or more.

The results showed that *B. welchii* was relatively decreased in the stools of the experimental group. A most striking contrast was brought out by the 1 : 100,000 dilutions. In these dilutions practically all the stools of the control group showed *B. welchii,* whereas none of those of the experimental group showed a growth of this micro-organism.

Cultivation of the stools did not demonstrate any hemolytic streptococci in either group. Enterococci, such as *Streptococcus faecalis,* were encountered in the stools of both groups but to a slightly less extent in the stools of those on the experiment diet. *Lactobacillus acidophilus* was not demonstrated possibly because of the high dilutions used in plating out the fecal specimens. It is believed, however, that the *L. acidophilus* could have been demonstrated relatively more in the stools of the experimental group, as the pabulum in this group was more favorable to its growth.

Observations on Intestinal Motility.—It was thought advisable to make a comparative study of the motility of the intestinal contents of the two groups of children during the last week of the experiment. Accordingly, as indicators, carmine was given to the experimental group and charcoal to the control group. In the experimental group, the average time for the first appearance of the coloring matter in the stools was eleven hours, and for the last appearance, forty hours; while in the control group the average time for the first appearance was seventeen hours, and for the last, forty-six hours.

HEALTH RECORD AND TEMPERAMENT OF THE CHILDREN

Neither group suffered any illness during the entire experiment. This was a fortunate outcome, for an outbreak of disease in the orphanage would have hampered seriously, if not terminated, the work.

General Appearance of the Children.—Many points in the comparative progress of the two groups have been brought out, but none seems as important, from the standpoint of the clinician, as the general appearance of the children. This is a feature that I am most desirous to stress. Irrespective of progress in all the criteria referred to in the preceding sections, the children on the experimental diet as a group were decidedly and emphatically superior to the control group in general appearance. This is not only a personal opinion, but also that of others who observed the children. On several occasions in the closing weeks of the experiment, the groups were lined up side by side, and unbiased observers were asked to tell which, in their estimation, appeared the healthier looking lot. Invariably the answer was in favor of the experimental group. Despite the report on the hemoglobin, the children on the experimental diet appeared to have a better color; their eyes were

brighter, their complexions were healthier, and their hair had a decided gloss. The last point was especially noticed by every one interested in the children.

Temperament of the Children on Experimental Diet.—On this point the sexes differed. The girls changed for the better. Many of them who had been irritable, cross and discontented, showed a decided improvement in disposition. The Sisters in charge of the institution volunteered the information that at play, in the school room and at the table their behavior was noticeably better than previously.

On the other hand, the boys did not do so well. This apparently was not due to the change in dietary. They had gained the impression that they were being experimented on, and this they resented. Furthermore, they took their meals in the same room as the boys on the control diet. The various dishes passing by that they had been accustomed to in the past, tempted them, and the fact that they were deprived of these foods reacted on their behavior unfavorably.

RESULTS OF PHOTOGRAPHIC STUDIES

Photographic studies offer an excellent method of following the improvement in nutritional status over a given period of time. To quote Clough and Murlin,[14] whose technic we have followed: "A visual picture of a child conveys at once a definite idea of the nutritional status, whereas figures alone do not call forth a definite mental picture." They further stated: "They give a truer impression of the children at the time when the records were made than can be given by any amount of description either verbal or written."

In line with what has been stressed in the preceding section, to the clinician the general appearance of a child is the most impressive index of its nutritional condition. The June and December pictures, of which only three representing the experimental group are shown, because of lack of space, bring out the decided effect of the experimental dietary on the general appearance and on the undernutrition of the children.

By the use of the technic developed by Clough and Murlin, changes in certain selected anatomic features may be measured on the negative under a magnifying glass by means of calipers. While they do not correspond exactly with measurements made of the skeletal structures used by anthropometrists, they are none the less useful. Some of the anatomic features referred to are: greatest width of face; width of neck at the narrowest point; distance from suprasternal notch to the umbili-

14. Clough, H. D., and Murlin, J. R.: Permanent Records of Growth and Nutrition of Children, Am. J. Dis. Child. **36**:425 (Sept.) 1928.

Fig. 5.—*A*, a child in the experimental group in June, at the beginning of the experiment; *B*, the same child in December, at the end of the experiment. The points of comparison are: width of face, width of chest, depth of chest and width of arm and leg.

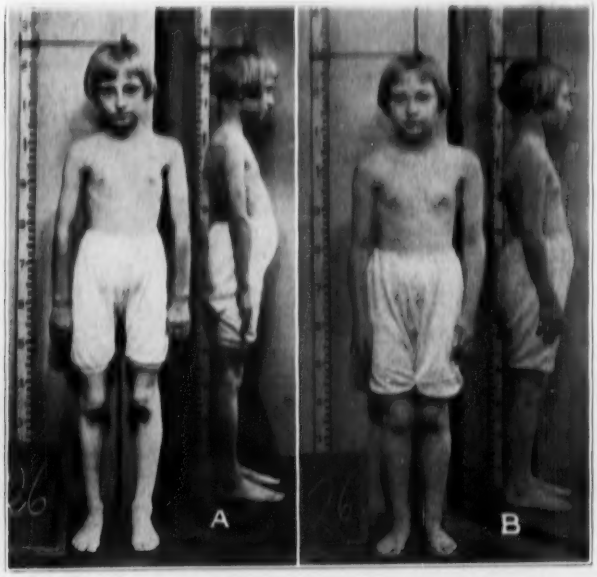

Fig. 6.—*A*, a child in the experimental group in June, at the beginning of the experiment; *B*, the same child in December, at the conclusion of the experiment. See legend for figure 5 for points of comparison.

cus; width of the chest at the level of the nipples; trunk length, i. e., from suprasternal notch to symphysis; greatest width of hips, of thigh and of leg; length of leg; distance from symphysis to ankle; and, in the lateral view, saggital head length, length of arm, length from shoulder to elbow, greatest width of arm, depth of chest, etc.

Using the photographs of June and December, I selected for comparison the following anatomic features: width of face, width of chest, depth of chest and width of arm and leg.

The comparative progress in both groups was noted as expressed in figures 8, 9, 10 and 11.

Fig. 7.—*A*, a child in the experimental group in June, at the beginning of the experiment; *B*, the same child in December, at the close of the experiment. The points of comparison are stated in the legend for figure 5.

The increase in inches is designated in the ordinate scale, and the individual cases of each group according to the increase in growth, in the abscissas.

The average increases in the development of the width of the face, width of the chest, depth of the chest and width of the arm were greater in the experimental group than in the control group. However, in the case of the width of the leg, the control group on an average showed a slightly greater increase.

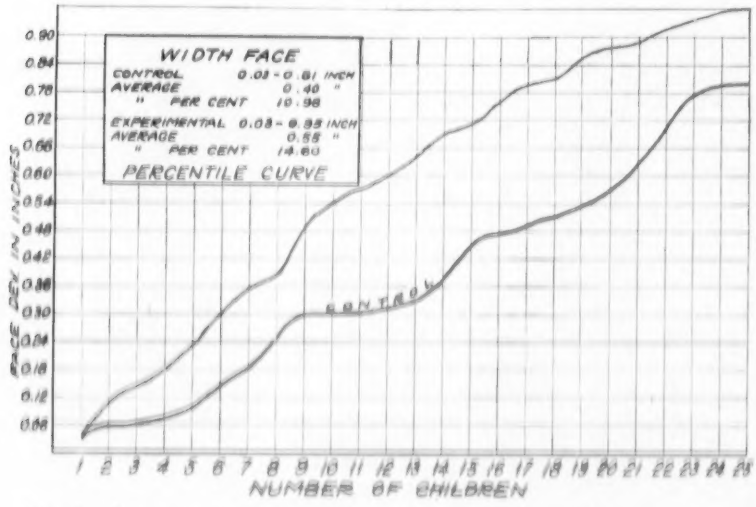

Fig. 8.—Increases in width of face in the experimental group as compared with those in the control group.

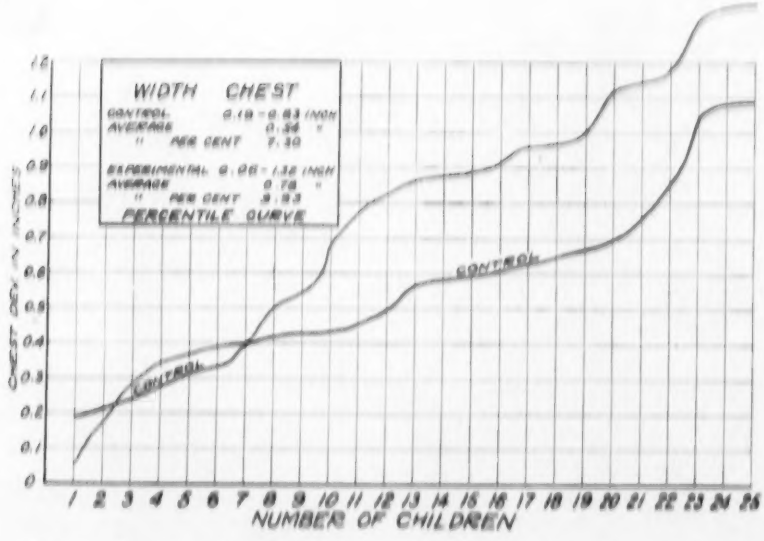

Fig. 9.—Increases in width of chest in the experimental group as compared with those in the control group.

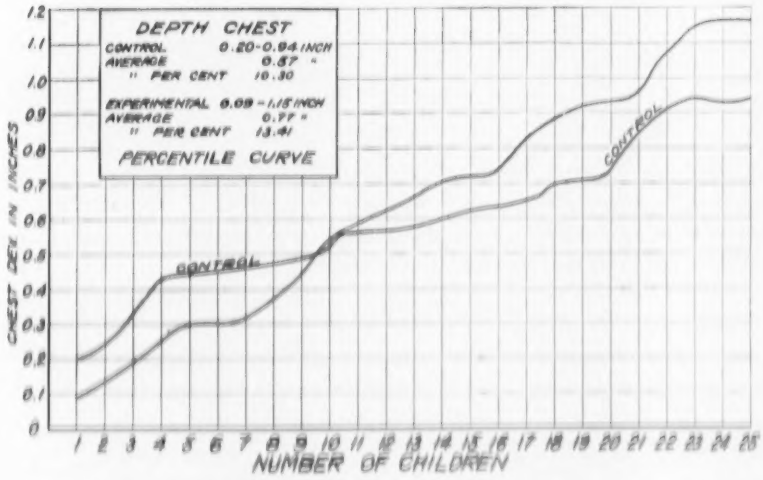

Fig. 10.—Increases in depth of chest in the experimental group as compared with those in the control group.

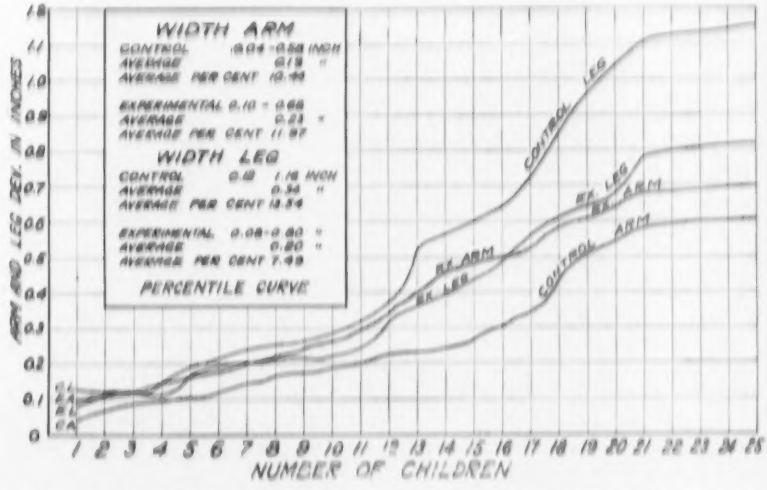

Fig. 11.—Increases in width of arm and leg in the experimental group as compared with those in the control group.

PSYCHOMETRIC RESULTS

Psychometric examinations were made in order to eliminate mentally defective children, to ascertain the general level of intelligence and to compare the mental growth of the two groups over the period of experimentation. The measure used was the intelligence quotient as derived from the Stanford-Binet test. The intelligence quotient under normal circumstances should be constant, and little change was expected among the children. However, in view of the fact that the decided change in diet created unusual circumstances that might be reflected in undue mental retardation or in mental acceleration, it was felt that a retesting in December was warranted.

Table 10 shows that the progress in mental development was practically equal for both groups. The 0.23 point difference in favor of the experimental group is hardly large enough to be significant.

TABLE 10.—*Results of Intelligence Test*

	Initial Average Mental Age	Final Average Mental Age	Gain	Initial Intelligence Quotient	Final Intelligence Quotient	Gain in Intelligence Quotient
Experimental group....	97.8 mo.	104.5 mo.	6.7 mo.	82.50	83.33	0.83
Control group.....	95.2 mo.	101.5 mo.	6.3 mo.	85.08	85.68	0.60

GROWTH AND VITAMIN STUDIES ON RATS

Both diets proved equal as far as growth-promoting properties were concerned. This was demonstrated by studies of growth made on rats, from weaning to 80 days. The dried foods [15] were fed to the growing rats and to rats deficient in vitamin B and vitamin G in order to obtain information on the growth-promoting properties as well as on the vitamin B and vitamin G contents of the diet.

Figure 12 shows the average changes in the weight of the rats on the two diets. The results indicate that both diets were adequate for growth. In one group, the control diet excelled, while in the other the experimental diet proved better.

15. An accurately weighed and measured portion of every constituent of the day's diet for the experimental group was placed in a big bucket, and the like for the control group in another bucket. At the end of each day the contents of each bucket were finely ground, mixed and spread in thin layers on a big glass plate. The two plates were placed in a rack under a hood where there were two large open containers of calcium chloride (to absorb the water) and a large electric fan, which blew warm air (of a temperature not over 50 C.) provided by a gas burner, over the moist food. When the food was entirely dry (in from six to eight hours), that on each glass plate was scraped off, pulverized and mixed well. The two lots of dried food comprising twenty-one consecutive meals from each group, were stored in two containers.

Experiments with vitamin B were performed on two groups of rats, one on each diet. The results indicate that both diets contained a sufficient amount of vitamin B to effect a complete cure of deficiency symptoms with the same rapidity.

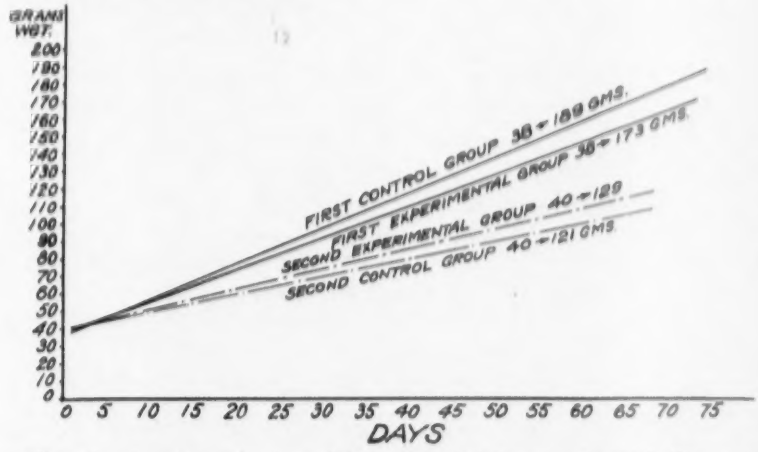

Fig. 12.—Average gains in weight in rats fed the experimental diet, compared with those in rats fed the control diet. All rats were the same age at the beginning of the experiment. Group 1 was started one week before group 2.

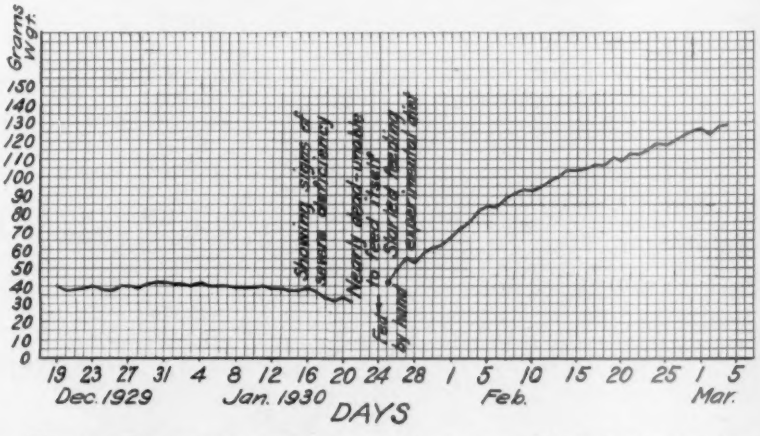

Fig. 13.—The weight curve of a rat fed a diet deficient in vitamins B and G from December 19 to January 21 (*A*), and the experimental diet from January 25 to March 4 (*B*).

Figure 13 shows an individual case of extreme deficiency in vitamin B cured by the experimental diet.

That an adequate intake of vitamin B complex is of paramount importance to the child is well recognized. The vitamin B portion, which

is notably lacking in the modern American diet is the normal stimulant for the appetite; it increases the intestinal tone and has antineuritic properties; whereas, the vitamin G portion has both pellagra-preventive and growth-promoting qualities.

RESULTS OF STUDIES OF NITROGEN BALANCE

In order to determine the utilization of the protein of the experimental diet as compared with that of the protein of the control diet, nitrogen balances were determined on five boys from each group.[16]

The feces were collected in small covered porcelain pails every morning before breakfast. Each child was instructed to empty his bladder immediately before breakfast (at the same time every morning), the twenty-four hour urine sample being collected in a stoppered glass jug containing a small amount of chloroform (used as a preservative). The twenty-four hour samples of feces were weighed each morning and then placed in air-tight wax containers and stored in the icebox. The daily samples of urine were made up to a definite volume with distilled water; an aliquot was placed in a stoppered pint glass bottle and stored in the icebox. A determination of total nitrogen was done on each day's sample.

At the end of the week, the feces for each child were pooled and mixed very thoroughly, and a determination of nitrogen was done on the mixture. This average value was used as the daily fecal nitrogen value.

The nitrogen balances were calculated for each child per day, the nitrogen lost in the perspiration being disregarded. The average percentage retention of nitrogen was calculated for each group. For the experimental group it was found to be 13.1 per cent and for the control group 7.7 per cent, with an average nitrogen intake of 8.82 Gm. and 14.13 Gm., respectively. The nitrogen retention figures are not exactly comparable because of the difference in nitrogen intake with the two diets. When the average absolute amount of nitrogen retained is considered, it is found that 1.16 Gm. was retained per child per day on the experimental diet and 1.10 Gm. retained per child per day on the control diet. There was difficulty in collecting the excreta. There were certain days (not included in the average results) when, as is known definitely, some urine or feces were not submitted to the sample by the child. The figures for the other days may or may not be significant. However, I feel assured in stating the conclusion that the results indicate that there is a slightly better retention in the children on the experimental diet. This retention for both groups falls within the average for growing children, from 1 to 2+ Gm. per day.

16. The total nitrogen intake was determined for each day by obtaining the nitrogen content of the food. An accurately measured portion of each diet was ground finely, mixed well and dried on a glass plate, the dried food being scraped from the plate and pulverized. Determinations of the nitrogen by Kjeldahl's method were made on each day's food.

COMMENT

Essentially, the diet advocated here for the correction of malnutrition is characterized by the exclusion of flesh foods and includes a combination of a large quantity of certified milk and milk products, whole grain cereal products, particularly whole wheat cereal, and an abundance of fresh vegetables, fresh fruits and nuts. It is not to be confused with a vegetarian diet, for vegetarian diets, in the true sense of the word, include no animal products. The diet here proposed is rich in milk and milk products. In connection with this fundamental dietary constituent, the effect of liberal amounts of milk on the nutritional status of a population has been pointed out by McCollum and Simmonds:[17] "Wherever dairy animals are abundant in proportion to the population and their products form the staple articles of diet, fine physical development is seen without exception."

Meat was eliminated from the diet because it appeared from experience gained through clinical observation that children thrived better without it. The exclusion of meat need arouse no concern, for Sherman[18] stated: "Nuts are comparable with meats as a food and may be used interchangeably with meat in the diet; in fact, they are being so used to an increasing extent." In reference to the various proteins, he said that milk is much superior to either eggs or meat.

It appears from the estimates made by the Food Research Institute[19] that the general trend is toward a possible decrease in the consumption of meats and cereals and toward an increase in the use of milk, sugar, fruits and vegetables.

The malnourished children who had been on the experimental diet had excelled those on the control diet, as shown by the following results in the criteria used: better progress in weight and height, in anthropometric measurements and in physical capacity tests; slightly better nitrogen retention; healthier character of the stools, with a reduced and simplified intestinal flora and improved intestinal motility, and, last but not least, better general appearance of the children. On the strength of these results, this type of diet is advocated for malnutrition.

This dietary is rich in alkaline ash foods. Diets of this type have been proposed by Sansum, Blatherwick and Smith[20] in the treatment

17. McCollum, E. V., and Simmonds, Nina: The Newer Knowledge of Nutrition, ed. 3, New York, The Macmillan Company, 1925, p. 409.

18. Sherman, H. C.: Chemistry of Food and Nutrition, ed. 2, New York, The Macmillan Company, 1924, pp. 248 and 399.

19. The Decline in Per Capita Consumption of Flour in the United States, Wheat Studies of the Food Research Institute, 1926, vol. 2, no. 8.

20. Sansum, W. D.; Blatherwick, N. R., and Smith, F. H.: The Use of Basic Diets in the Treatment of Nephritis, J. A. M. A. 81:883 (Sept. 15) 1923.

for nephritis and hypertension; by Pearson and Wyllie [21] for rheumatic fever and for eczema, and recently by Mayer and Kugelmass [22] for tuberculosis. Furthermore, the value of the alkaline type of diet was brought out by Seccombe,[23] who stated that a diet containing an excess of acid-forming elements is believed to predispose to dental caries. In a study of the effects of natural acid-forming and base-forming diets on the metabolism of young rats, Samuel and Kugelmass [24] concluded that acid-forming diets inhibit, and base-forming accelerate, the rate of growth, development, metabolism and activity.

Not many experiments in nutrition have been carried out on children. Most of them have been done with animals. Experimentation on a group of children such as I have conducted is an extremely difficult and tremendous undertaking. Consequently, oversights are bound to occur and obstacles to arise. Thus, in criticizing my own work, I note the following: In selecting the children, I probably should not have included any at the age of pubescence. Fifty children were possibly not enough. The experiment should perhaps have run twelve instead of six months. The dietaries of the groups might have been reversed at the end of the six months' period and the changes noted. The caloric value of the diet used for the control group was higher than that used for the experimental group for the greater part of the experimental period. The boys were not under satisfactory control. The person who was in charge of the boys was antagonistic to the idea, whereas the one in charge of the girls was cooperative. This may be the factor in explaining the superior progress of the experimental girls, instead of the inference made in a preceding paragraph that there might be a possible difference in the nutritional needs of the two sexes. Because of these probable errors I regard this work as only preliminary and not conclusive in its scope. Further experimentation will be undertaken.

Another valid argument against a possible sex difference in dietary requirements is that I was able to show that the diet was adequate also for boys, as indicated by the results of the studies of nitrogen balance.

Finally, it is interesting to note that the Sisters in charge of the orphanage were so impressed with the results that at the termination of the experiment all the children in the institution were put on the experi-

21. Pearson and Wyllie (footnote 6, pp. 45 and 372).

22. Mayer, E., and Kugelmass, I. N.: Basis (Vitamin) Feeding in Tuberculosis, J. A. M. A. **93**:1856 (Dec. 14) 1929.

23. Seccombe, W.: Diet in Relation to Oral Hygiene, J. Nat. Dental A. **8**:441, 1921.

24. Samuel, E. L., and Kugelmass, I. N.: Comparative Studies of the Influence of Acid-Forming and Base-Forming Diets on the Metabolism of Rats, Am. J. Dis. Child. **39**:687 (April) 1930.

mental dietary. After six months it is still being continued by them with enthusiasm. One of the statements volunteered by the dietitian in charge was that in her twenty years' experience she had noticed that children who consumed much meat were never satisfied, that frequently within an hour after a meat meal they were ready for a sandwich. With the new diet, however, their appetites were always satisfied.

SUMMARY

Two groups of underweight children, each consisting of twenty-five subjects, were selected and matched according to age, height, weight and sex. One was put on a special dietary (experimental) and the other on a representative American dietary (control), and the progress of one group was compared with that of the other at the end of a period of six months.

The experimental dietary consisted of a quart of certified milk daily, a variety of nuts, whole grain cereal products three times a day and fresh fruits and fresh vegetables twice a day, meat and eggs being excluded. It is obvious that there was a preponderance of basic over acid-forming elements.

The increase in weight proved the experimental diet superior from the standpoint of rapidity, as well as of permanence, of results. The increase in weight in the experimental group at the end of the six months' period was 32 per cent greater than that in the control group.

The increase in height was 24 per cent greater in the experimental group than in the control group.

The more extensive anthropometric data established the validity of the results in the study of the weight gains, while further technical treatment of these data in relation to the girths of arm and calf and the subcutaneous tissue over the biceps corroborated the superiority of the experimental dietary.

The results proved the experimental dietary to have been superior for girls to a greater extent than for boys. It is likely that psychic factors played an important rôle in the production of this sex difference.

The studies of the blood showed no difference in progress for the two groups.

The urinalyses indicated a much lower acidity for the experimental group than for the control group.

The psychometric studies and the roentgen examination of the bones were not conclusive.

The stools of the two groups showed a decided contrast in physical appearance, with a diminution in the total number of bacteria in the stools of the experimental group.

The studies of nitrogen balance indicated a slightly better retention for the experimental group.

The experimental dietary was proved to be rich in vitamin B complex, as indicated by the studies on rats.

The importance of the vitamin B complex content in a child's dietary is stressed.

Both diets as tested on rats were shown to contain sufficient vitamin B to effect a complete cure of symptoms of deficiency with the same rapidity.

Case Reports

THE CLINICAL AND ROENTGENOLOGIC MANIFESTATIONS OF SCURVY IN A SEVEN YEAR OLD CHILD*

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Poupart [1] wrote one of the first descriptions of adult scurvy in 1669. He described crepitus in the epiphyses of bones, and noted that there were separations of the epiphyses from the shafts. Petit described similar cases in 1773.

In 1859, Moeller [1] described a disease in infants characterized by swelling of the extremities, pseudoparalysis and bleeding of the gums. He thought that this disease was an acute form of rickets. In 1883, Barlow [1] recognized the scorbutic origin of the disease described by Moeller, and proved his statements anatomically. However, there was still much confusion between rickets and scurvy, probably because the diseases occurred together so frequently. As time went on cases of Moeller-Barlow disease were observed in infants who did not have rickets, and the identity of this disease and adult scurvy was definitely recognized. The German literature still calls infantile scurvy the Moeller-Barlow disease.

There have been few cases of this disease recognized in late childhood. In 1903, Fraenkel [2] described the condition in a child, aged 7 years, and wrote a complete summary of the case, including a careful report of the pathologic examination. In 1918, during the World War, Tobler recognized and treated 200 patients in an asylum for refugee children in Vienna. In both instances the roentgenographic studies were incomplete.

The following case is presented to help bridge the gap in knowledge between infantile scurvy and adult scurvy, and to show the roentgeno-

* Submitted for publication, July 17, 1930.

* From the Departments of Pediatrics and Roentgenology, Cleveland City Hospital, and the Departments of Pediatrics and Pathology, Western Reserve University.

1. Quoted by Tobler, Walter: Der Scorbut im Kindesalter, Ztschr. f. Kinderh. **18**:63, 1918.

2. Fraenkel, Eugen: Untersuchungen über Möller-Barlowsche Krankheit, Fortschr. a. d. Geb. d. Röntgenstrahlen. **7**:300, 1903.

graphic differences between scurvy in the infant and that in the older child.

REPORT OF CASE

History.—W. K., a boy, aged 7 years, of Italian parentage, was admitted to the Cleveland City Hospital in November, 1929. The mother stated that the child's left leg had started to swell about two weeks before admission. At first, the swelling was limited to the lower part of the leg, but gradually it became more marked and extended upward to the hip. The leg seemed to be quite painful from the onset. The child had never been able to walk or talk, and a diagnosis of imbecility had been made in the outpatient department three years before admission to the hospital. The patient had not been seen in the outpatient department for eight months. The past history was essentially irrelevant except for common colds and a chronically discharging ear.

The patient was the second of three children. The first was a year older, and the third was two and one-half years younger. Both were apparently average in size and mentality. There had been no other pregnancies. The mother had epilepsy. The father had always been healthy. The mother was carefully questioned regarding the child's diet. She said that she had given from 8 to 10 ounces (226.8 to 283.5 Gm.) of pasteurized milk purchased from the "corner grocery" three times a day, oatmeal or farina three times a day and bread without butter frequently. No vegetables or meat had been given because the child would not chew. She claimed that she had given some orange juice, but admitted that the child had had very little. The probable amount could not be ascertained. She was certain that she had given none for two or three weeks before admission. Cod liver oil had never been given.

Examination.—The child was obviously an idiot. He was small in stature, and his state of nutrition was poor. When undisturbed, he would lie quietly on his back with his knees wide apart and flexed. Whenever he was touched or moved, he cried out. The respirations were normal in character and rate. The head was small and symmetrical. The conjunctivae and the mucous membranes of the nose and mouth were normal in color, and there were no petechiae. The gums were firm, with no evidence of hemorrhage. There were twenty-two teeth, all in good condition. The tonsils were small. There was some foul discharge from the right ear. The lungs, heart and abdomen presented nothing abnormal. A few posterior cervical glands were palpable.

There was a marked swelling of the left knee, somewhat spindle-shaped and involving the lower two thirds of the thigh and the upper one third of the lower leg. There was no redness. This area was extremely tender and quite firm, and a slight crepitus could be elicited just above the knee. The tenderness seemed more marked over the condyles of the femur. The knee joint was flexed, and any attempt at either active or passive motion was extremely painful. The right leg seemed somewhat painful, but no swelling was noted. The upper extremities did not seem painful, and no swelling was present. The temperature on admission was 38.5 C. (101.3 F.), but it was normal in three days.

Examination of the blood showed: white blood corpuscles, 18,200, and two days later, 11,500; red blood corpuscles, 4,720,000, and the hemoglobin content, 80 per cent (Tallquist). The results of the urinalysis for albumin and the occult blood test were negative. There were no elements resembling red cells. The capillary permeability test gave negative results. The eyegrounds were examined, and no hemorrhages were found. The Wassermann reaction of the blood was negative.

Roentgenograms of the left lower extremity were taken the day after the patient's admission to the hospital (figs. 1 and 2). The shaft of the femur and both epiphyses at the knee showed an absence of normal trabeculation of the bone, being more marked in the distal epiphysis of the femur. This epiphysis was separated and displaced laterally. There was a slight increase in the amount of calcification at the cortical border of the diaphyso-epiphyseal line. The epiphyseal line was sharply defined. Both epiphyses were surrounded by delicate lines of increased calcification. The tibia and fibula also showed a lack of normal trabeculation.

Figure 1

Figure 2

Fig. 1.—Anteroposterior view of the left lower extremity on admission. The bones show an absence of normal trabeculation. This is most marked in the distal epiphysis of the femur, which is separated and displaced laterally. There are irregular shadows of calcium deposit at the diaphyso-epiphyseal line just proximal to the displaced epiphyses.

Fig. 2.—Lateral view of the left lower extremity on admission.

Six days later, the right leg in the region just above the knee became swollen and seemed much more painful than it had been on admission. There was no crepitus. There was a somewhat "boggy feel" deep in the tissues. Roentgenograms of the right lower extremity (fig. 3) showed an almost identical appearance

with that of the left. Roentgenograms of the upper extremities showed no changes. Because of the probability of scurvy, the patient was given 90 cc. of orange juice twice a day. Extension apparatus was applied to both legs. The patient appeared much more comfortable in five or six days. The swelling gradually decreased in amount. In two weeks, the region above the knees became hard and firm. The femora were greatly increased in size, the increase being most marked on the posterior and lateral surfaces just above the knees.

Course.—Roentgenograms taken three weeks after the orange juice was started (fig. 4) showed a remarkable change. The shafts of both femora were surrounded

Figure 3

Figure 4

Fig. 3.—Anteroposterior view of the right lower extremity six days after admission, showing a lesion almost identical with that in the left lower extremity on admission. The calcium deposit is less.

Fig. 4.—Anteroposterior view of the left lower extremity taken after three weeks of antiscorbutic therapy. There is a wide homogeneous shadow of increased calcification surrounding the entire femur. This is the subperiosteal hemorrhage which has become calcified. The trabeculation of the bone is still indistinct.

by homogeneous, wide shadows of increased calcification which extended from the epiphyseal lines to the region of the lesser trochanters. The calcification was more marked on the left femur. The epiphyses showed a fairly good alinement.

In six weeks the epiphyses appeared firmly united (fig. 1). The trabeculation of the bone was indistinct. The calcification around the shaft was about the same. There was a remarkable amount of calcification around the epiphyses, producing the effect of a "frame." All signs of tenderness had disappeared. On palpation, the femora were still thickened and firm.

At the time of writing, eight months later, the condition of the femora, both clinically and roentgenographically, had remained the same, with the exception that the trabeculation of the bone was more distinct.

Fig. 5.—Anteroposterior view of both lower extremities taken after six weeks of antiscorbutic therapy. The calcification extends from the epiphyseal lines to the region of the lesser trochanters. The shadow is wider on the left side. Note the rings of calcification around the distal epiphyses of the femora.

COMMENT

This is the first case of scurvy in childhood we have had the opportunity to observe. We were accustomed to make the roentgenologic diagnosis of scurvy, in part at least, on the appearance of the Trümmerfeld and Gerüstmarkzone, described by Fraenkel [2] and later by Wim-

berger,[3] but these were not present in this case. The diagnosis of scurvy was considered as a possibility, but we could not regard the case as scurvy until the patient began to have symptoms in the other leg, and the roentgenograms revealed a similar process there.

The absence of petechiae, bleeding gums and blood in the urine, even though we recognize that their presence is not essential to the diagnosis, made the case more baffling from the clinical standpoint. The diagnosis was not finally made until the tenderness in the legs definitely improved with the administration of orange juice, and the roentgenograms showed marked calcification of the hemorrhages.

The extent of the subperiosteal hemorrhages and the epiphyseal separations was remarkable. The Trümmerfeldzone and Gerüstmarkzone, which are so important in the roentgenologic diagnosis of infantile scurvy, were absent. These signs consist of an irregular, dense shadow at the end of the shaft and a band of diminished density just beneath. These shadows probably occur only in infantile scurvy and are in some way associated with the increased vascularity accompanying the rapid growth in that portion of the bone at that time. The situation may be comparable with that in congenital syphilis, as it is well known that the younger the infant, the more probable is the presence of lesions at the ends of the diaphyses, and the older the child, the more probable are the periosteal lesions. Furthermore, the ends of the diaphyses of the femur at this age are normally quite irregular, and any changes are difficult to evaluate.

The roentgenograms of this patient showed the ground glass appearance of the shafts and rings of increased density around the epiphyses of the femora and tibiae. These rings are said to develop incident to the excess of bone resorption over deposition, the same process that occurs at the metaphyseal line of the long bones. The center of the epiphyseal body itself becomes rarefied and develops its own Trümmerfeldzone at the marginal circumference, the contrast presenting a well defined ring of greater density, around the shadowy central structure. These have been especially emphasized in infantile scurvy by Wimberger[3] and Pelkan.[4] In this patient the rings became much more marked as healing progressed.

Traumatic epiphyseal separation or a separation due to an early osteomyelitis of the distal end of the shaft of the left femur was considered as a diagnosis on admission, chiefly because of fever and local-

3. Wimberger, Hans: Klinisch-radiologische Diagnostic von Rachitis, Scorbut und Lues congenita im Kindersalter, Ergebn. d. inn. Med. u. Kinderh. **28**:264, 1925.

4. Pelkan, K. F.: The Roentgenogram in Early Scurvey, Am. J. Dis. Child. **30**:174 (Aug.) 1925.

ized tenderness, but when the same lesion was found on the right side, the process was definitely decided to be a systemic disease rather than a localized lesion.

Syphilitic osteochondritis with epiphyseal separation could scarcely be considered in a child 7 years of age. Syphilitic periostitis in childhood and in adult life has a "lacework" appearance. In this case the periosteal shadow was homogeneous.

The absence of evidence of active hemorrhage, that is, petechiae in the gums, the mucous membranes and the skin, and of blood in the urine might be explained by the fact that the disease was not active when first seen. In support of this view we have the signs of calcification or beginning healing in the first roentgenograms.

Scurvy in childhood is a rare disease in this country and probably occurs only under the most unusual circumstances, such as were present in this case. The patient was unable to masticate ordinary foods, including vegetables and meats, and was given a very limited diet, which was incomplete in regard to the vitamin content because of the low intelligence of the parents. Such a combination of factors necessary for the development of this disease is unusual.

CONCLUSIONS

A case of scurvy in a child of 7 years, with complete serial roentgenograms, is presented. The case is interesting for two reasons: (1) the unusual age of the patient, and (2) the absence of the most typical roentgenologic changes seen in infantile scurvy, the Gerüstmarkzone and the Trümmerfeldzone.

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ACUTE POLYMYOSITIS *

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Acute polymyositis is a comparatively rare condition in childhood. The case to be described here is being reported for the following reasons: It conforms to the classic description of polymyositis; the course was hyperacute, ending in death within ten days; pathologic observations established a streptococcus as the etiologic factor, and finally there was a possible association between the fatal illness and a streptococcus infection that occurred a year previously.

REPORT OF CASE

Joan S., 5½ years old, had suffered from measles and chickenpox at the age of 2½ years, and had had the usual infections of the upper part of the respiratory tract. One year previous to the present illness, when she was 4½ years old, a discharge from the ear developed. A month later, a subperiosteal abscess formed in the region of the zygomatic bone, and a mastoidectomy was done. The postoperative course was stormy, with high fever; *Streptococcus hemolyticus* bacteremia developed, and an extraperitoneal metastatic abscess formed in the right lower quadrant of the abdomen, which required drainage. Subsequently, the mastoid wound was revised, and eventually a tonsillectomy was done.

For a period of a year following the mastoidectomy and its sequelae, the patient was exceptionally well.

In the spring of 1929, a physician, called in to see the patient's brother, examined Joan S. and found a mild infection of the upper part of the respiratory tract. A few days later, swelling of the submaxillary and parotid regions on the right side developed, with high fever. A history of exposure to mumps was obtained. The swelling subsided after a few days, but the temperature gradually rose, without remissions, to 105 F.

On examination at that time, the fifth day of illness, the child was seen for the first time by us. She had high fever, 105 F., but did not look critically ill. The chief complaint was extremely severe pain in the right knee; yet examination of the knee joint and of the soft parts showed no limitation of motion and no tenderness. In fact, aside from a palpable spleen, the examination yielded negative results. The blood count showed moderate leukocytosis and polynucleosis. Blood for culture was not taken. The impression was that the child was suffering from a severe general (grippal) infection and toxic neuritis. On the following day the temperature dropped to normal only to rise again to 101 F. on the day afterward. The child was again seen by us and presented a striking clinical picture. The pain, which had spread to both arms, the other leg and the upper part of the trunk, was extremely acute. The child shrieked in agony and begged

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not to be moved. The muscles were exquisitely tender. This could be demonstrated particularly well in the pectoral region where grasping the pectoral fold caused great pain. There was no swelling or edema in any part of the body. A general adenopathy was present in addition to a palpable spleen. At this time, a diagnosis of polymyositis was made.

On the following morning, the patient began to improve, but by evening the pain became hyperacute, and even morphine was of no avail. Swelling of both forearms occurred. The appearance of the arms is worthy of note. The swelling extended from the wrist to a little above the cubital space; the skin was red and shiny, yet there was no brawny edema. It was as if all the soft

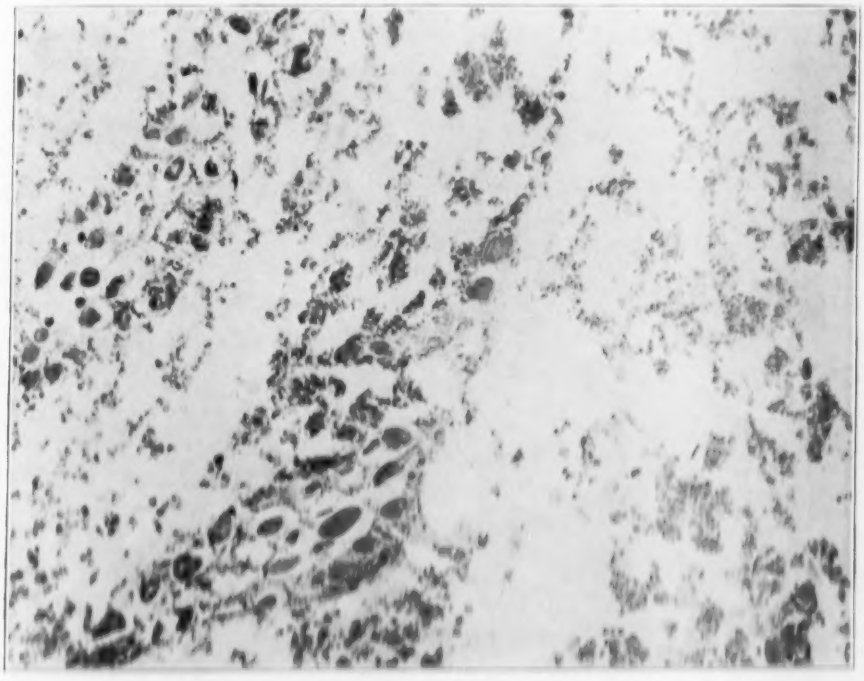

Fig. 1.—Section of muscle showing almost complete destruction of muscle bundles, and masses of bacteria.

parts, including the skin, had been infiltrated suddenly and completely with fluid. The child became unconscious and rapidly weaker. The pulse, at times imperceptible, apparently responded to stimulation, only again to collapse. The child died from cardiac failure on the tenth day of the disease.

Two weeks after the death of the patient, a severe case of mumps developed in her brother.

To recapitulate, a child, aged 5, fell ill suddenly with a swelling of the face suggesting mumps. Fever persisted despite the disappearance of the swelling. Thereafter pain, muscular tenderness and swelling of the arms occurred, with prostration and death.

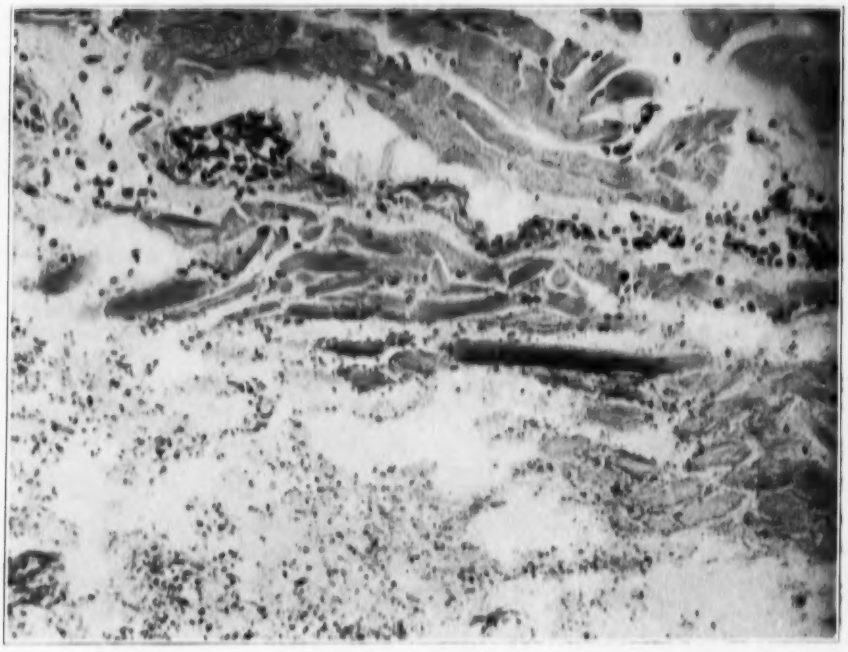

Fig. 2.—Section of muscle showing inflammatory reaction and disintegration.

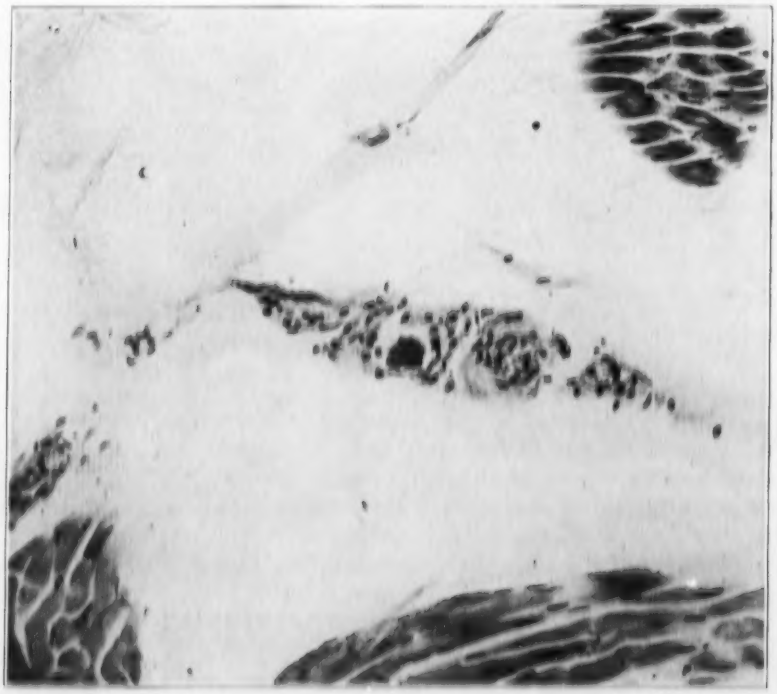

Fig. 3.—A small blood vessel containing a mass of bacteria (gram-positive streptococci).

Autopsy.—The essential observations in the autopsy report prepared by Dr. Paul Klemperer are the following:

The lungs showed a few circumscribed hemorrhagic areas. The spleen was markedly enlarged, weighing 250 Gm.; on section, the color was dark red, and the pulp could be scraped off easily. The muscles in various regions of the body "appeared pale, but no diagnostic importance could be placed upon these findings."

The microscopic changes in the muscles are illustrated by the accompanying photomicrographs. The essential lesion was the severe damage to the muscle bundles. In some places, there was merely loss of the transverse striae, whereas, in other parts, there was practically complete destruction, only shreds of tissue being left (fig. 1). The muscle bundles were separated by leukocytic infiltration, and leukocytes were also found about the smaller vessels (fig. 2). In the section stained for organisms, myriads of gram-positive cocci could be seen, and in one place a small vessel was plugged with bacteria (fig. 3). The failure of cellular reaction about the masses of bacteria indicates the overwhelming type of the infection and the absence of resistance on the part of the patient.

Diagnosis.—The anatomic diagnosis was: hemolytic streptococcus septicemia, acute purulent myositis, infectious splenic enlargement and hemorrhages into the lungs and pleura.

Bacteriologic Examination.—The spleen yielded a pure culture of hemolytic streptococci.

COMMENT

The essential feature of this case was the overwhelming infection and the predilection of the organism for muscular tissue. The finding of so many streptococci scattered widely throughout the muscle bundles and of the pure culture of *Streptococcus hemolyticus* in the spleen seems to warrant the assumption of sepsis even in the absence of a blood culture. The almost complete absence of inflammatory reaction about the masses of streptococci indicates great virulence or overwhelming number of bacteria and, on the other hand, lowered resistance of the patient.

The possible relation of the fatal illness to the series of severe infections that occurred one year previously is interesting. It will be recalled that a mastoidectomy was done, that a blood culture on one occasion was positive for *Streptococcus hemolyticus,* and that a metastatic abscess developed. It is conceivable that during this twelve month period streptococci may have been lying dormant and that some exciting circumstance suddenly permitted them to spread throughout the body. Similar recurring infections from old osteomyelitic foci in the long bones are well recognized. In this case, the occasion for the flareup of the old infection may have been an attack of mumps or of grippal infection.

Polymyositis has been reported as following other infections, such as measles, and severe mumps might have led the way in this case. The child's previous condition may have had one other bearing on the final illness. The previous streptococcus infection may have rendered the patient particularly susceptible to reinfection with this organism. These

points of view are of importance, even though not susceptible of proof. In cases in which the disease is not so fulminating and in which complete autopsy can be done, such conceptions may be adequately investigated.

Polymyositis as recorded in the literature [1] presents a varied picture. The onset is characterized by systemic symptoms, such as malaise, headache, generalized pains and fever of low grade. As a rule, these prodromes last several days or even weeks. Edema not only occurs over the larger muscles, but at the beginning of the illness may affect the face. For this reason, confusion with trichinosis occurred; in the earlier literature the term pseudotrichinosis was used, and a parasite was described as a possible causative agent. The edema of the affected part is usually extensive, severe and of long duration. As a rule, it affects muscle, subcutaneous tissue and skin, and in this respect the description of the type of edema in our case conforms accurately to that found in the literature. Other skin lesions, such as erythema, urticaria, pseudoerysipelas and scleroderma, have been noted. Though fever may be high, from 104 to 105 F., as in our case, as a rule it is moderate. Pain is always present and varies in intensity, at times being so severe that the patient fears to be moved or touched. Any striated muscles may be affected including those of the diaphragm, the larynx and the pharynx; usually involvement of muscles is extensive and may include apparently all the muscles of the body. In cases of long duration the muscles are hard and infiltrated, so that extensive limitation of motion is caused, with prolonged confinement to bed; eventually atrophy and contractures may occur. When the outcome is not fatal, the muscles become normal, or varying degrees of muscular atrophy and dysfunction persist. Aside from the local conditions described, examination reveals only a hypertrophied spleen and glandular enlargement. Although in general polymyositis is a disease of middle life, the extremes of age are not spared; cases are recorded which occurred in children of 3 years of age and others which occurred in elderly persons. The sexes are equally affected. Myositis, dermatitis and pain are the three striking characteristics. The degree of involvement of nerves, muscle, skin and other organs has led to a varied nomenclature, different authors calling the condition neuromyositis, neuroangiomyositis and dermatomyositis, according to the structures affected.

1. von Meyenburg, H., in Henke and Lubarsch: Handbuch der speziellen pathologischen Anatomie und Histologie, Berlin, Julius Springer, 1926, vol. 9, pt. 1, p. 380. Steiner, W.: J. Exper. Med. **6**:407, 1905. Friedman, E. D.: M. J. & Rec. **123**:382, 1926. Lorenz, in Nothnagel: Handbuch der speziellen Pathologie und Therapie, Vienna, Alfred Hölder, 1898, vol. II, pt. 3. Schüller, A.: Jahrb. f. Kinderh. **58**:193, 1903. The first two references contain satisfactory bibliographies.

The most frequent complications are bronchopneumonia, bronchitis, nephritis, ulceration of the mucous membrane and myocarditis. Naturally, respiratory infection is likely to occur in those cases in which the muscles of respiration and deglutition are affected, and pneumonia then is the immediate cause of death.

The course may be hyperacute, as in our case, or prolonged over a period of months, indeed for as long as two and one-half years. Even in favorable cases, recovery takes place only after many weeks of illness. Prolonged duration does not imply favorable prognosis; often after months of illness death occurs from asthenia, bronchopneumonia, suffocation or myocarditis. The prognosis is grave, the literature recording a mortality of more than 50 per cent.

Diagnosis involves the differentiation of this condition from trichinosis, neuritis and other forms of infectious disease. In trichinosis, eosinophilia is characteristic, and biopsy usually completes the clinical picture. Both neuritis and polymyositis are characterized by pain, but in the former nerve tenderness is present, a symptom not found in polymyositis. Also, the reaction of degeneration present to a greater or less degree in neuritis is absent in polymyositis. With respect to infections of other origin, the absence of the local symptoms and the general examination supply the only method of differentiation.

It is generally assumed that the term polymyositis excludes the purulent forms of myositis (gross abscesses in the muscles), as well as those nonpurulent types with a specific etiology, such as syphilitic, rheumatic or gonorrheal myositis. Grossly, the muscles show an abnormal color varying from gray-brown to yellow, and a change in consistency, usually being soft and easily torn. In the microscopic picture, the most striking feature, which varies in detail, is the degeneration of muscle bundles. Fatty, granular, cystic and waxy degenerations are described, and there may be areas of complete necrosis, as in our case. Muscle bundles are separated by edema of the interstitial tissue, which is more or less infiltrated with cells of various types. In a few cases, minute hemorrhages occur. In cases of long standing, the destroyed muscle bundles may be replaced by fibrous tissue. The finding of organisms in microscopic sections, as described in our case, is recorded in the literature, but is rather the exception than the rule. Enlargement of the spleen is a frequent observation, and occasional myocardial changes have been noted.

The etiology is still obscure. The early impression that a protozoon caused the disease is now only of academic interest, because of repeated failure to find such a protozoon. A toxic origin, from meat poisoning or gastro-intestinal absorption, and an origin in prolonged exposure to cold and dampness have been mentioned. Cases also have been described

as occurring after infections, measles, grip, pertussis and, in our case, possibly mumps. Even though many of the factors mentioned are not of primary etiologic importance, they may serve in individual cases as predisposing causes. The etiology ascribing an infection as the origin is supported by a number of observations, though no single organism can be incriminated; staphylococci, streptococci and unidentified cocci in chains are most frequently described. Sometimes these have been cultured from the muscles, and at other times they have been found in microscopic sections, as in our case. The mere fact that such bacteriologic observations have not been constant does not militate against the theory of the infectious origin of the disease. In old cases in which fibrosis has already taken place reports of negative bacteriologic results are to be expected. Indeed, an exudative type of inflammatory reaction with necrosis and bacteria, as in our case, infiltration with small, round cells and moderate fibrosis in others and atrophy with fibrosis in the chronic cases form a natural pathologic background for the assumption of an infectious etiology. One cannot but agree with von Meyenburg that "the entire picture conforms definitely to that of a generalized infection with particular involvement of the muscular system."

Finally, the essential identity of the various types of polymyositis and dermatomyositis should be emphasized. Long or short duration of the disease, greater or lesser intensity of the process, limitation to muscles or extension to skin, presence or absence of organisms, and acute or chronic inflammation are variations that fall within the concept of a single disease. The fulminating case that we are reporting probably forms one end of a long chain, the other end of which is represented by an illness lasting many months and characterized by pain, progressive inability to walk, edema, asthenia and eventually either death or very slow recovery.

SUMMARY

A case of polymyositis in a child is reported. Although the course of the disease was peculiarly acute, nevertheless the clinical features were those described in the chronic forms under the title dermatomyositis —exquisite tenderness and also involvement of the skin with doughy swelling confined to the middle of the extremities. Autopsy indicated that the essential pathologic development in this case was sepsis with localization of the organism chiefly in the muscles.

57 West Ninety-First Street.
163 West Eighty-First Street.

MONGOLISM IN ONE OF TWINS *

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CHARLESTON, S. C.

To Brousseau's [1] collection of thirty-two cases of mongolism in one of twins, Shattuck [2] and Chown [3] have each recently contributed another instance. The following case brings the number to thirty-five.

History.—These twins, seen first on May 17, 1929, were born at full term on Feb. 16, 1925. At the time of delivery the mother's age was 35, and the father's age was 45. There was a sister four years older, and a brother was born three years after the twins. There had been one stillbirth. The mother appeared to be rather unintelligent, but all the children except one of the twins were said to be normal.

The twins were breast fed for only a few days, and subsequently were given dried milk mixtures. Both of them had influenza at 2 years and measles at 3 years of age. When seen at the age of 4 years and 3 months, the boy appeared to be nearly normal, with a fairly bright expression, a slender build, moderate parietal bossing and several carious deciduous teeth. The girl was a typical

Development and Measurements

	Boy	Girl
First tooth	6 months	6 months (?)
First sat	6 months	36 months
Age first walked	12 months	(Not yet)
Age first talked	12 months	(Not yet)
Standing height	38½ inches (97.71 cm.)	31 inches (78.74 cm.)
Weight	29 pounds (13.3 Kg.)	19 pounds (8.6 Kg.)
Circumference of head	20¾ inches (52.7 cm.)	17 inches (43.55 cm.)
Circumference of chest	21½ inches (54.6 cm.)	18½ inches (46.99 cm.)
Circumference of abdomen	18 inches (45.72 cm.)	18½ inches (46.99 cm.)

mongolian, showing retarded growth, slanting eyes, large furrowed tongue, irregular and carious teeth, lax joints, square hands, cold, pale skin, a loud precordial systolic murmur and a rachitic rosary and squared head.

The developmental history and measurements are shown in the table.

The Wassermann and Kahn tests were negative. The girl did not respond to any mental tests, while the boy's intelligence quotient (Binet) was 85.

Seven months later the measurements were as follows: In the boy, the head measured 21 inches (53.34 cm.) and the chest, 21½ inches (54.61 cm.), the height was 40 inches (101.6 cm.) and the weight, 31 pounds (14,061.6 Gm.). In the girl,

* Submitted for publication, June 30, 1930.

* From the Department of Pediatrics, Medical College of the State of South Carolina.

1. Brousseau, Kate: Mongolism, Baltimore, Williams & Wilkins Company, 1928.

2. Shattuck, R. H.: Mongolism in One Twin, J. A. M. A. **92**:1593 (May 11) 1929.

3. Chown, Gordon: A Case of Mongolian Idiocy, Occurring in One of Male Twins, Canad. M. A. J **17**:943 (Aug.) 1927.

Fig. 1.—Twins at the age of 65 months.

Fig. 2.—Comparison of the development of the left hands of twins (left, boy; right, girl) aged 5 years and 4 months.

the head measured 17¾ inches (44.45 cm.) and the chest 19¼ inches (48.89 cm.); the height was 32½ inches (81.8 cm.) and the weight, 18 pounds and 14 ounces (8,561.7 Gm.).

The girl suffered from an obstinate case of constipation. The administration of thyroid extract had no beneficial effect on her development.

COMMENT

This case of mongolism in one of dizygotic twins supports the view that the condition is the result of a defect in germ plasm and not due to the general physical condition of the parents.

ACUTE PHOSPHORUS POISONING

REPORT OF A CASE DUE TO INGESTION OF FIREWORKS *

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AND
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The incidence of phosphorus poisoning has decreased greatly in recent years, if the number of cases reported in European and American journals is taken as an index of its frequency. Undoubtedly the decrease is due mainly to the prohibition of the manufacture and sale of yellow phosphorus matches. In China and in Japan, where the use of yellow phosphorus matches is widespread, the number of cases of phosphorus poisoning is increasing.[1] In this country there are still two easily available sources of yellow phosphorus, certain brands of rat and roach paste and certain types of fireworks. Both of these constitute a special menace to children.

Phosphorus paste is occasionally resorted to for suicidal purposes,[2] is used as an abortifacient,[3] or is ingested accidentally.[4] We have found two records of accidental poisoning of small children by this agent, one with recovery [5] and one fatal case.[6]

The source of phosphorus to which we wish to call attention is fireworks, and especially one type of fireworks which, because of its "harmless" nature, is considered safe in the hands of small children. This is a red composition of phosphorus mixed with other ingredients, put up

* Submitted for publication, July 16, 1930.

* From the Department of Pathology, University of Chicago.

1. Vogt, Volrath: A Case of Phosphorus Poisoning, China M. J. **38**:123, 1924. Kiang, P. C.: Studies in Acute Phosphorus Poisoning, China M. J. **40**: 1091, 1926. Read, B. E.: Poisoning Statistics, Nat. M. J., China **12**:46, 1926.

2. Bamberger, J.: Zur Insulinbehandlung hepatargischer Zustände (Phosphorvergiftung), Deutsche med. Wchnschr. **53**:1690, 1927. Rossier, Paul H.: Contribution à l'étude de l'intoxication aiguë par le phosphore, Schweiz. med. Wchnschr. **8**:890, 1927. Swinton, C. F.: Acute Phosphorus Poisoning, Brit. M. J. **2**:1080, 1927.

3. Hann, Reginald G., and Veale, R. A.: A Fatal Case of Poisoning by Phosphorus with Unusual Subcutaneous Haemorrhages, Lancet **1**:163, 1910.

4. Jennicke, Eugen: Seltene pathologisch-anatomische Befunde: Akute Phosphorvergiftung, Deutsche med. Wchnschr. **45**:603, 1919. Petri, Else: Zur pathologisch-anatomischen Diagnose und Histologie der Phosphorvergiftung, Frankfurt. Ztschr. f. Path. **25**:195, 1921.

5. McIntosh, Rustin: Acute Phosphorus Poisoning: Report of a Case with Recovery, Am. J. Dis. Child. **34**:595 (Oct.) 1927.

6. McLean, Stafford; MacDonald, Aildred; and Sullivan, Ruth C.: Acute Phosphorus Poisoning from the Ingestion of Roach Paste: Report of a Fatal Case in a Child, J. A. M. A. **93**:1789 (Dec. 7) 1929.

in a small packet, and commonly marketed under such trade names as "Son-of-a-Gun," "Spit-Devil" and "Devil-on-the-Walk." It is ignited by friction, and sparkles and crackles when ground beneath the heel. Salls [7] stated that chemical analysis shows a yellow phosphorus content of "several per cent." Corwin [8] gave the figure as 10 per cent. We wish to report a case of phosphorus poisoning traced to this source.

REPORT OF A CASE [9]

History.—A boy, aged 4½ years, had always been well until he developed a mild attack of whooping cough, about April 23, 1928. He had frequent attacks of violent coughing, without a typical whoop and not accompanied by vomiting. At no time did he appear to be very ill. On the evening of May 26, the child ate a hearty supper and later complained of pain in the abdomen. During the night he had a violent attack of vomiting, and the vomitus contained recognizable food. The attack abated, but for the next two days he was less active than usual, and complained of thirst and pain in the abdomen. On May 29, the parents noticed that the sclerae were yellow. Urination was frequent, and the urine was dark yellow. On this day the child was well enough to be taken shopping in the neighborhood. The next day he appeared less well, was less active and complained of abdominal pain and soreness in his arms. In the evening the parents thought he had a fever, though the temperature was not taken.

At 3:30 a. m., on May 31, the parents found the child with staring eyes and occasionally twitching muscles. He failed to recognize them, and they summoned a physician for the first time. The physician prescribed a hot bath, which produced a distinct improvement, and the child fell asleep. During the following day he was kept in bed. He ate and drank as usual, and appeared interested in things about him.

At 1:30 a. m. on June 1, the child woke up, moaning and crying, and complained bitterly of pain in the abdomen. He seemed only partly aware of his surroundings. He vomited, and from this time on vomiting was persistent. The vomitus was a brownish fluid, apparently, from the parents' description, of the coffee ground type. An internal squint suddenly developed, accompanied by a conjunctival hemorrhage at the outer angle of the right eye. The physician was again sent for. The summary of his observations was as follows: projectile vomiting, cephalic cry, rigidity of the neck, internal strabismus of the right eye, right conjunctival hemorrhage, inequality of the pupils, partial paralysis of the right arm and leg, positive Kernig and Babinski signs, hyperesthesia, icterus and no abnormal conditions in the abdomen and thorax.

The condition remained the same throughout the night. By morning, the icterus had increased and was particularly noticeable on the face, over the nasal bones. The abdomen became distended, and several bluish spots, about the size of a match head, appeared in the skin. The child died at 10:45 a. m. on June 1, on the seventh day after the onset of symptoms.

On the basis of the terminal clinical picture, the first diagnosis was acute meningitis. Also, because of the history of a recent attack of whooping cough, we considered the possibility that we were dealing with a case of the rare neurologic

7. Salls, C. M.: The Menace of Phosphorus Fireworks, New York State Dept. of Labor, Indust. Hyg. Bull., 1924, vol. 1, p. 21.

8. Corwin, A. S.: Report of a Case of Phosphorus Poisoning from Sucking a Spit-Devil, New York State J. Med. **22**:475, 1922.

9. Dr. F. H. Muller of Chicago supplied the clinical data in this case.

manifestations of this disease, a pertussis eclampsia.[10] However, the results of the necropsy suggested that the condition was an acute intoxication, and the resemblance to the changes found in cases of phosphorus poisoning was observed. Subsequent questioning of the parents elicited the statement that on the afternoon of May 26, several hours before the first gastro-intestinal symptoms appeared, the mother had taken away from the child a Son-of-a-Gun which he was sucking. According to the father, the label on the package stated that the fireworks were poisonous and contained phosphorus. The mother was uncertain whether the time observed was the only occasion on which the child had put a Son-of-a-Gun in his mouth.

Necropsy.—Necropsy was performed in the home thirty hours after death. The body had been embalmed within an hour after death. The embalmer's incisions were present in the abdomen and the right supraclavicular fossa, and there were many puncture marks in the viscera.

There was a moderate icterus of the skin and sclerae. In the lateral angle of the right eye, there was extensive hemorrhage into the bulbar conjunctiva. The pupils were equal and moderately dilated. In the skin over the abdomen were several bluish-green petechiae. Small hemorrhages were seen in several places between the leaves of the mesentery and in the transverse mesocolon. There was extensive hemorrhage in the mediastinum, especially in the tissues about the esophagus. The esophageal mucosa was roughened and brown in places. The heart and large blood vessels appeared normal. The lungs were well collapsed and were grossly normal. The liver was large, and its rounded margin extended 6 cm. below the right costal margin. It was a uniform pale yellow, and, on the cut surfaces, the lobular outlines were indistinct. The gallbladder was empty, and the extrahepatic bile ducts were patent. The spleen was large, but not grossly abnormal. Examination of the brain showed the dura mater under increased tension and a slight pressure groove about the cerebellum. (The significance of these last observations in a body embalmed by intravascular injection is dubious.) In other respects, there were no gross changes in the brain and meninges.

Microscopic Examination.—In the esophagus, there was extensive sloughing of the epithelium, with areas of hemorrhage in the mucosa, submucosa and tissue surrounding the esophagus. There was a moderate infiltration of the mucosa by lymphocytes, polymorphonuclear neutrophils and occasional eosinophils, and there were a few groups of similar cells in the submucous and muscular coats.

Everywhere in the stomach and small and large intestine, distended mucous-secreting cells were numerous. The lymphoid tissue of the intestinal wall was hyperplastic, with large follicles containing germinal centers. In the lumen of the appendix, there was a cross-section of a small parasitic worm, probably *Oxyuris vermicularis.* Frozen sections, stained with sudan III and counter-stained with hematoxylin, revealed an unexpected degree of fatty change in the gastric epithelium, located chiefly in the parietal cells, which were swollen and filled with fat. Elsewhere in the gastro-intestinal tract, fine fat droplets were seen in a few epithelial cells and in cells of the germinal centers of some of the lymph follicles.

The liver showed an extreme degree of vacuolization of the hepatic cells. Large vacuoles were rare, and there were few cells of the signet ring form. The hepatic cell nuclei appeared normal. Only an occasional sinusoid could be distinguished,

10. Hiller, Friedrich; and Grinker, Roy R.: Functional Circulatory Disturbances and Organic Obstruction of the Cerebral Blood Vessels: With a Contribution to the Pathology of Pertussis Eclampsia, Arch. Neurol. & Psychiat. **23:** 634 (April) 1930.

because of the swelling of the hepatic cords. In the connective tissue about the portal triads were numerous lymphocytes, polymorphonuclear neutrophils and eosinophils. The biliary ducts appeared normal. Small hemorrhages were seen in the mucosa of the gallbladder, with extensive hemorrhage in the serosa. In the sections of the liver stained with sudan III, there was much fat in the hepatic cells, in fine and coarse droplets. There seemed to be some vacuoles which failed to stain with sudan III.

The pancreas appeared normal, but the stain for fat showed a few fine fat droplets in most of the cells of the acini and islets.

The suprarenal glands appeared normal. A considerable amount of fat stained with sudan III appeared in the glomerular and reticular zones, and less in the fascicular zone of the cortex.

In the kidneys, the tubular epithelium was swollen and vacuolated, and in many tubules the lumina were greatly decreased. There was some karyolysis in the tubular epithelium. These changes were most striking in the convoluted tubules, but were present to a lesser extent in the loops of Henle and the collecting tubules. Precipitated protein was present in the glomerular spaces and the lumina of the tubules. In the sections stained for fat, the accumulation of fat in the renal epithelium paralleled the vacuolization seen. Few fat droplets were present in the glomerular tufts.

The wall of the urinary bladder appeared normal, but the sections stained with sudan III revealed minute fat droplets in the epithelium.

The myocardium appeared normal, and the striations were distinct. In contrast, the sudan III sections showed abundant minute fat droplets in muscle fibers. The distribution of fatty fibers was patchy.

The lungs, trachea and bronchi appeared normal. In the sections stained with sudan III, there were fat droplets in the parenchyma of the lung and in the tracheal and bronchial epithelium, particularly in the cells of the mucous glands. Fat was conspicuous in the cartilage cells, each one of which contained several fine and coarse globules. Fat emboli were seen in several lung capillaries.

The sinusoids of the spleen were engorged with blood. The lymphoid corpuscles were hyperplastic. Eosinophils were abundant in the pulp. A few cells of the pulp and some of the cells in the germinal centers of the follicles contained fat.

In the thymus, there were areas of interstitial and parenchymatous hemorrhage. The eosinophilic cells were numerous.

In the striated muscle of the diaphragm, there were a few pale swollen fibers. In the section stained with sudan III, most of the fibers contained no fat. A few fibers with well preserved striations contained many minute fat droplets. In a few swollen fibers with no visible striations, many small and large globules of fat were present.

The abdominal lymph nodes showed both lymphoid and reticulo-endothelial hyperplasia. Large cells within and lining the sinuses contained fine fat droplets.

The tissues of the mediastinum and the mesentery showed extensive hemorrhage and no other change.

In sections of the brain stained with hematoxylin and eosin, no abnormalities were seen. Staining with sudan III disclosed several conspicuous features. Fat emboli were seen plugging several capillaries. There were large cells laden with fat in the perivascular spaces and in the pia-arachnoid. In some regions a few fat droplets were seen in the parenchyma.[11]

11. Reports of morphologic observations on the brain in phosphorus poisoning are rare. A special study of the brain in this case, with reference to the neurologic symptoms, will be reported later.

In addition to the fat emboli seen in the capillaries of the lung and brain, occasional fat emboli were present in many of the other organs. In most of the sections, the endothelial cells of the small blood vessels contained a few fine fat droplets, and a few scattered histiocytic cells in the stroma were filled with fat.

Examination with the polarizing microscope showed anisotropic as well as isotropic fatty substances in the epithelium of the stomach, liver, kidneys and suprarenal glands.

COMMENT

The agent implicated in our case has been the cause of phosphorus poisoning in a number of reported cases. In communications to the editor of the *Journal of the American Medical Association,* Stacy, Busey and McCornack [12] discussed the case of the 15 month old son of Dr. Stacy, who ate the unburned remnant of a Devil-on-the-Walk and died four days later. Corwin [8] recorded the death of a 3 year old girl, forty-six hours after placing a Spit-Devil in her mouth. Corwin stated that he had heard of four similar cases occurring in the same year in New York. Salls [7] reported that the Bureau of Industrial Hygiene of the New York State Department of Labor had, in 1924, records of the deaths of seven little children who had put this type of fireworks into their mouths. It is probable that Salls' figure includes Corwin's case and the others referred to by him. Piersol and Klemmer [13] described a case of phosphorus poisoning in a 13 year old girl, who ate a small portion of a Son-of-a-Gun and died four days later. Dwyer and Helwig's [14] patient was a 3 year old boy who died four days after eating a Spit-Devil. Dr. Robert A. Black, of Chicago (personal communication), saw, as consultant, a 4 year old child who, according to his parents, had eaten two or three Son-of-a-Guns. On the bases of the history and the necropsy observations, the coroner signed the death certificate "phosphorus poisoning."

All of the cases mentioned presented in varying degrees the manifestations of acute phosphorus poisoning as described by Holland,[15] in the excellent review by Thayer and Wolf,[16] and in the older medicolegal works. Postmortem examinations were made in the cases of Corwin,[8] Piersol and Klemmer,[13] Dwyer and Helwig,[14] as well as in

12. Stacy, W. C.; Busey, C., and McCornack, P. D.: Dangers of Phosphorus in Fireworks, Communications to the Editor, J. A. M. A. **77**:1514 (Nov. 5) 1921.

13. Piersol, George M., and Klemmer, Roland N.: A Case of Acute Phosphorus Poisoning, Proc. Path. Soc. of Philadelphia **27**:48, 1925.

14. Dwyer, Hugh L., and Helwig, Ferdinand C.: Phosphorus Poisoning in a Child from the Ingestion of Fireworks, J. A. M. A. **84**:1254 (April 25) 1925.

15. Holland, J. W.: Phosphorus Poisoning, in Peterson, F.; Haines, W. S., and Webster, R. W.: Legal Medicine and Toxicology, ed. 2, Philadelphia, W. B. Saunders Company, 1923, vol. 2, p. 146.

16. Thayer, A. E., and Wolf, C. G. L.: The Toxicity of Tetra-Phosphorus Tri-Sulfid, J. M. Research **9**:191, 1903.

Black's case and our own. In every instance the results were those considered characteristic of, if not pathognomonic for, acute phosphorus poisoning. In none of these cases was metallic phosphorus demonstrated. In fact, of the foregoing cases, phosphorus was detected in the viscera only in the case of roach paste poisoning reported by McLean, MacDonald and Sullivan.[6] Our patient died on the seventh day, and it was considered futile to test for phosphorus, in view of the fact that metallic phosphorus is soon converted into salts of no value to the medicolegal observer.[15] The coincidence of the ingestion of fireworks known to contain phosphorus with the clinical and postmortem observations leaves little doubt that our case, like the others, was a case of acute phosphorus poisoning.

With twelve fatal cases, including Dr. Black's and our own, reported in the medical literature, we can only guess at the total number of nonfatal and fatal cases of poisoning due to this source. Of interest in this connection is a report of a survey of Fourth of July accidents, conducted by the American Museum of Safety.[17] The survey covered all reported accidents occurring in 1927, in 600 cities in 43 states. According to the report, the eating of fireworks caused the death of sixteen very small children, through phosphorus poisoning. The evidence in hand warrants increased recognition of the danger of phosphorus poisoning, and calls for agitation against the laxity that permits such dangerous objects to fall into the hands of children.

SUMMARY

The risk of acute phosphorus poisoning has been decreased but not eliminated by the prohibition of the manufacture and sale of yellow phosphorus matches.

The ingestion of fireworks containing phosphorus is a cause of acute phosphorus poisoning in children.

A case of fatal phosphorus poisoning in a 4½ year old boy, traced to such a source, is described.

A review of the medical literature reveals a total of twelve reported cases. There is evidence that this figure does not give a true idea of the frequency of phosphorus poisoning caused by fireworks.

The commonly implicated agent is a single type of fireworks, variously known as "Son-of-a-Gun," "Devil-on-the-Walk" and "Spit-Devil."

17. Many Victims of Fourth of July Celebrations, Editorial, Safety Engineering **54**:122 (Oct.) 1927.

A TIP FOR THE GASTRODUODENAL TUBE DESIGNED FOR NASAL PASSAGE IN INFANTS AND IN CHILDREN *

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In studies on the gastroduodenal contents of infants and children, it was found more satisfactory to pass the gastroduodenal tube through the nose rather than through the mouth, for the following reasons:

1. The subject cannot resist the passage of the tube by clenching the teeth, biting the tube, elevating the tongue or refusing to swallow.
2. The position of the tube in the digestive tract is not obscured by redundant coils in the mouth.
3. The gag reflex is less readily stimulated. There is less retching, vomiting and choking.
4. The flow of saliva which may dilute the gastric contents is not stimulated.
5. The tube cannot be injured or severed or aspiration stopped during episodes of negativism on the part of the subject.
6. Test meals and feedings are more readily taken and swallowed when the tube is not in the mouth.

A tube could not be found on the market that was entirely satisfactory for nasal passage in children. The ordinary rubber catheter was unsatisfactory because it did not possess a weighted tip as a leading point, and too frequently coiled in the stomach or admitted a side loop into the duodenum. The Jutte tube as modified by Davison [1] frequently failed to penetrate the narrow nasal passage of infants and children. The Rehfuss tips were too large. The mercury-weighted tube of Wilkins [2] was too wide and not entirely suitable for the aspiration of duodenal contents because the perforations were set too far from the end.

To meet the need for a gastroduodenal tube with a perforated, weighted end that could be introduced through the nasal passage of the smallest infant, the tip here described was devised:

The tip is torpedo shaped and made of German silver, although nickel, brass, steel or silver would do as well. It weighs about 1.5 Gm. The threaded end of

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* From the Infants and Childrens Hospital and the Department of Pediatrics, Harvard Medical School.

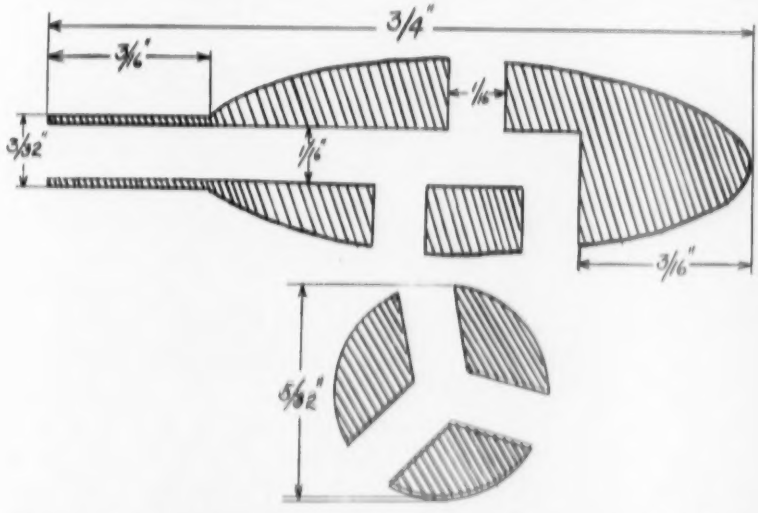
1. Davison, W. C.: The Duodenal Contents of Infants in Health and During and Following Diarrhea, Am. J. Dis. Child. **29**:743 (June) 1925.

2. Wilkins, J. A.: Mercury-Weighted Stomach Tube, J. A. M. A. **91**:395 (Aug. 11) 1928.

the tip is attached to stiff tubing with a bore of one-sixteenth inch and a total diameter of one-eighth inch. The details and specifications are given in the schematic drawing. The tip was made by E. F. Mahady Company, Boston, from whom duplicates may be obtained.

The tip was used in over 200 patients of all ages, including the youngest infants and a number of adults. It proved entirely satisfactory. When the proper length of tubing was inserted, it entered the duodenum readily.

The length of tubing introduced was found to be the most important factor in determining the facility with which the tip entered the duo-



Schematic drawing of gastroduodenal tip designed for nasal passage in infants and children.

denum. The following tabulation gives the approximate lengths to be introduced through the nose in order to bring the tip into the second part of the duodenum:

Age	Length in Cm.
0–3 mo.	30–40
3–6 mo.	34–40
6–12 mo.	34–45
1–2 yr.	35–49
2–4 yr.	43–49
4–6 yr.	43–50
6–8 yr.	52–61
8–10 yr.	52–61
10–12 yr.	52–65

In introducing the tube, about 10 cm. less than the length required is rapidly inserted. The child is then turned on its right side, or in a prone position with the left side slightly raised by pillows. The remainder of the calculated length is then slowly fed. This procedure generally brings the tip into the duodenum, although occasionally it is necessary to withdraw a few centimeters of tubing and start over again. A change in the patient's position, massage of the upper part of the abdomen, or the administration of a drink of water is often helpful in facilitating the passage of the tube.

Peter Bent Brigham Hospital.

Progress in Pediatrics

II. THE CORRELATION OF THE ROENTGENOGRAPHIC AND PATHOLOGIC ASPECTS OF CONGENITAL OSSEOUS SYPHILIS

WITH PARTICULAR REFERENCE TO THE FIRST MONTHS OF LIFE*

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The chief purpose of this study is to determine the value of the roentgenogram in the diagnosis of congenital syphilis and to correlate the roentgenologic picture with the underlying pathologic changes. The observations are based on the examination of more than 1,500 x-ray films of syphilitic infants, many of which were studied serially. It is not intended to offer the roentgenologist or clinician a substitute for scrupulous, critical examination, nor is it suggested that roentgenology will ever assume the place now held by serology in the diagnosis of the disease. It is only by the correlation of clinical, serologic and roentgenologic observations that knowledge of congenital syphilis will be furthered.

The rigidity of bone is maintained by the calcium salts which are in a fine state of dispersion and reflect the structural organization of the organic constituents. By virtue of their ability to interrupt the passage of the x-rays, the bones in rapidly growing infants are capable of revealing information concerning the state of health of the child sometimes not otherwise obtainable.

Cartilage does not become bone directly, but undergoes resorption and disappears in order that it may finally be replaced by bone. Bone appears to be subordinated to a great number of influences which tend to make it disappear. As soon as the equilibrium is broken in some way, resorption comes into play. The phenomena of resorption appear to be of the first order in skeletal physiology; they dominate the pathology of bone.[1]

It should be kept in mind that bone grows in length only by virtue of its epiphysial cartilage. In fact, one might state that the shaft has been inherited from its epiphysial cartilage.

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* From the Babies' Hospital and the Department of Diseases of Children, Columbia University.

1. Leriche, R., and Policard, A.: The Normal and Pathological Physiology of Bone: Its Problems, St. Louis, C. V. Mosby Company, 1928, pp. 25 and 89.

Pathologists often make the error of thinking of the bones in terms of the thin microscopic section, which does not give a true picture of a structure of three dimensions. Roentgenologists, on the other hand, often think in opposite terms, that the structure or the structural change seen on the roentgenogram is a picture of every section cut from that particular bone.

The following description of the phenomenon of the growth of bone by Eliot, Souther and Park [2] is particularly clear. Without a working knowledge of this phase of physiology many of the statements which follow might seem obscure.

> Growth in length of the long bones takes place as the result of growth of the cartilage. The cells in the generating portion of the proliferative cartilage multiply continually during the periods of longitudinal growth of the bone, and keep giving off cells toward the shaft and away from the nucleus of ossification. Growth at the upper end of the tibia, for example, is due to the fact that the generative portion of the proliferative cartilage keeps lifting itself by continually producing cells from its under surface which accumulate between its under surface and the upper end of the shaft until converted into bone. What the blood vessels and other building forces of the marrow do is to turn the material furnished by the cartilage into bone. As fast as the cartilage supplies its cells to the waiting blood vessels and the cells of the shaft, so fast do these latter convert the cartilaginous material into shaft. Naturally, those cartilage cells nearest the shaft are the oldest. These oldest cells have probably undergone some chemical or physical change in the process of waiting, which gives to their exoplasm, the homogeneous ground substance which fills in the spaces between the cell columns, some special power to attract lime salts from the blood. At any rate, in the ground substance surrounding these oldest cartilage cells which lie next to the shaft, lime salts are deposited. The blood vessels with their enveloping cells from the marrow cavity penetrate the spaces which intervene between the calcified ground substance of the cartilage and either free or destroy the cartilage cells which lie in them. They then begin the process of encasing the calcified ground substance with bone.
>
> The cartilage leads in the process of longitudinal growth, the shaft follows. The cartilage furnishes to the shaft design and, at the same time, material on which to build, in the form of longitudinally arranged hollow cylinders of calcified intercellular ground substance. In consequence, the trabeculae of the shaft have their characteristic parallel arrangement in the long axis. Parts of the material the shaft builds into bone; other parts, which presumably have already served their purpose when they emerge from the cartilage, it destroys.

OSTEOCHONDRITIS

Early Stages.—The lesions situated at the junction of the shaft with the epiphysial cartilage, usually called osteochondritis, will be considered

2. Eliot, M. M.; Souther, S. P., and Park, E. A.: Bull. Johns Hopkins Hosp. **41**:375 (Dec.) 1927.

first, because of their frequency as compared with other lesions. There seems to be an almost unanimous opinion among those who have written on osseous syphilis that in fetuses, as well as infants in the first weeks of life, a deepening in the longitudinal axis of the provisional zone of calcification of the long bones, shown on the roentgenogram as a white cap on the diaphyses and on the positive print as a dark metaphysial band

Fig. 1.—W. H., aged 7 weeks, colored, showed severe clinical manifestations. The serology of the mother and infant was positive. The proximal and distal ends of the tibiae and fibulae show metaphysial "capping." The upper quarter of both tibiae shows rarefaction and absence of cortex on the mesial aspects. The lesions at the metaphyses are suggestive at this age, but the symmetrical cortical rarefaction is pathognomonic of syphilis.

(fig. 1), is evidence of syphilitic involvement of the bones. It has been my experience that the roentgenologist should be cautious about making a diagnosis of syphilis on this evidence alone, and that the pathologist might be equally confused unless he was able to demonstrate spirochetes

in the lesions, a difficult matter in infants who have lived for some weeks, but less difficult in fetuses.[3]

Although the roentgenologist is willing to defer to serology and clinical manifestations for the diagnosis of syphilis in a case showing the aforementioned osseous changes—and if these are positive, he is probably right in his inference that the bony changes are due to syphilis—he cannot make an unequivocal diagnosis of the disease on this roentgen evidence alone. He is, however, entitled to an explanation of these osseous changes and might ask, Is there any other condition that might cause the same roentgen picture?

The previously mentioned authors have shown that if rats are kept on a deficient diet, which permits them to live but not to grow or to grow only very slowly, the deposition of lime salts in the thin layer of cartilage bordering on the shaft becomes very dense. In the thin zones of provisional calcification in both animals and children whose growth had almost stopped, they noted deposits of lime salt so dense that in the hematoxylin and eosin stained sections the zones appeared as continuous narrow blue bands marking the border of the shaft of cartilage.

Conditions other than those produced by the spirochete will produce these vagaries of calcification at the metaphyses, since they have been noted by me in four instances in nonsyphilitic infants (fig. 2). Furthermore, one cannot state that the actual lesion is a local specific one due to the presence of the spirochete, even in a syphilitic infant, since the widening of the provisional zone of calcification may be due to the growth-retarding effect of the syphilitic virus on the organism, even as starvation unfavorably affects the impulse to growth.

If, on the other hand, the syphilitic infant comes to autopsy, what pathologic changes are found to have produced the broadening or widening (increase in the diameter parallel to the longitudinal axis) of the over-prominent zone of calcification? Macroscopically, the metaphysis is broader than normal, usually from 2 to 3 mm., is whitish yellow instead of pink and feels gritty to the probe. Microscopically, the gritty over-calcified zone usually consists of a great number of interlocking tiers of calcified intercellular ground substance arranged in lattice formation (fig. 3). This so-called chalk grating possibly gives a clue to the

3. The nomenclature of Lexer (General Surgery, New York, 1908) will be followed throughout this study; in addition to its brevity it has much to recommend it. "There is the shaft and to it the technical term of the diaphysis is applied. At one or both ends of the shaft there is the epiphysis, and between epiphysis and diaphysis, as long as the growth in length persists, there is the disc of the epiphyseal cartilage. That portion of the shaft (diaphysis) which abuts on the epiphyseal cartilage possesses certain peculiarities, and it has therefore been given a special name, the metaphysis."

amount of calcium required at that particular metaphysis for the normal growth of bone from the period of the first effect of the syphilitic virus on osteogenesis to the date of the first roentgen observation. In other words, the diaphysial machinery for the production of bone has had the normal quantity of raw material available, in the form of calcified intercellular ground substance, for the manufacture of bone, but some inhibitory influence has disturbed the automatic levers (the blood vessels of the shaft) which bud out from the shaft to the proliferating cartilage and encase the calcified ground substance with osteoblasts and convert it into bone. The substance that has disturbed this delicate mechanism may be the syphilitic virus. In consequence, the unused raw material (the calcified intercellular ground substance) piles up at the

Fig. 2.—Lower three fourths of the femora, showing accentuation of the metaphysis and submetaphysial rarefaction. X-ray pictures were taken at the age of 10 weeks because of suppurative arthritis of the right hip with questionable bacteremia. There was no clinical suggestion of syphilis. A routine micro-Kahn test made at 10 weeks gave negative results. The Wassermann and Kahn reactions were negative at the age of 7 months.

metaphysis and explains the dense white shadow shown by the x-rays at the end of the bone, which in gross section appears as a broad, yellowish, cement-like zone separating the epiphysial cartilage from the shaft.

Not infrequently there is associated widening (in its longitudinal axis) of the cartilage proliferation zone. Less frequently there is a reduction of the proliferation of cartilage which seems to lead to widening of the horizontal septums of the cartilage ground substance.

According to my experience, the next stage in order of severity of lesions at the epiphyses shows on the roentgenogram a very slight or very marked degree of submetaphysial rarefaction, either with or without the deepened provisional zone of calcification (fig. 4). In the first months of life, when scurvy does not have to be excluded, I know of no disease but congenital syphilis which will frequently produce this picture, but it does occasionally occur in conditions other than syphilis, as shown in figure 2. At autopsy this type of lesion has been shown

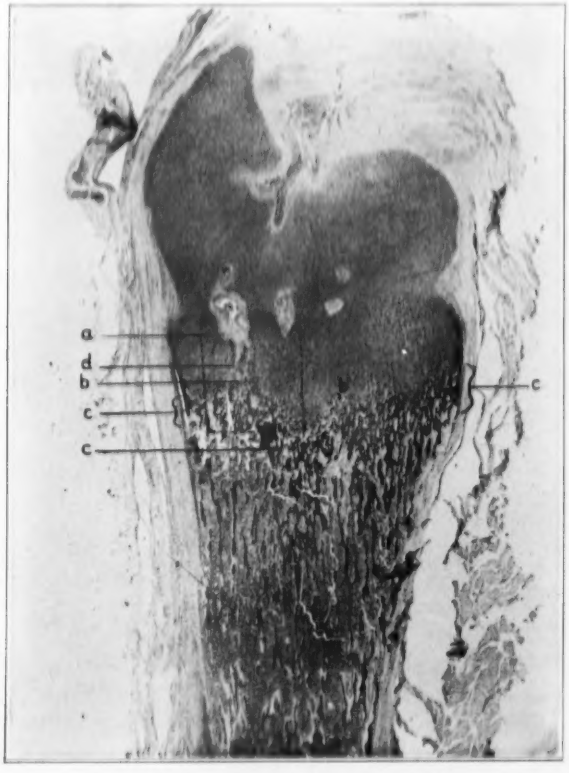

Fig. 3.—Photomicrograph of the distal end of the ulna of a syphilitic infant who died at the age of 2 days. The lines marked *c* indicate the dense irregular deposit of lime salt, which explains the heavy white cap seen by the x-rays on the ends of the long bones. This overcalcified zone consists of intercellular substance. Deposits of lime salt in the cartilage are irregular; in some places they are lacking, in others, they are far in excess of normal and project as spurs, as shown at *b*. These projections into the cartilage of lime salts explain the zigzag appearance at the metaphysis seen on x-ray films of certain syphilitic bones. At *a* is an enlarged cartilage canal containing connective tissue, blood vessels, stellate and fusiform cells and some fat. *d* shows deposits of lime salt along the cartilage canal.

by Schneider to contain spirochetes. It has been seen by us in infants proved to have syphilis by severe clinical manifestations, by multiple serologic tests or by autopsy disclosing specific pathologic changes in various organs. Eliot, Souther and Park found thin lines or rarefaction in bones that were not syphilitic. They stated that these are apparently the opposite of zones of increased density, in the sense that the destruc-

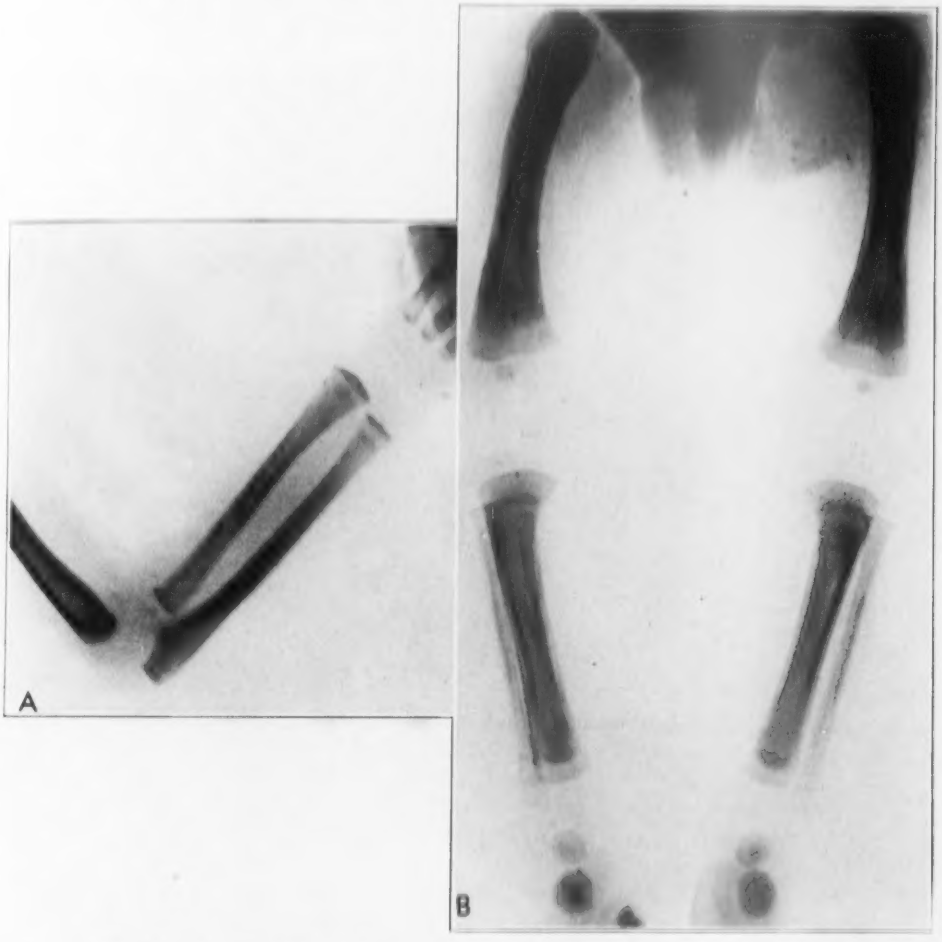

Fig. 4.—*A*, a syphilitic infant, aged 9 weeks, showed marked submetaphysial rarefaction at the distal ends of the radius and ulna, with moderate accentuation of the metaphyses. *B*, a syphilitic infant, aged 4 weeks, showed an extreme degree of submetaphysial rarefaction at both ends of all the long bones, without metaphysial accentuation as seen in *A*. There is no piling up of lime salts at the ends of the bone as shown at *b* in figure 3. The centers of ossification of the tarsal bones show a central nucleus with a peripheral zone of rarefaction apparently analogous to the zone of rarefaction at the ends of the long bones.

tive forces of the shaft were ascendant along large parts of the under surface of the cartilage at the time of their formation. They suggested that deficient circulation might be the cause of the destruction of the columns of intercellular substance. These authors stated that x-ray pictures of the bones of children who have been in poor health or poor states of nutrition may show broad transverse zones in which the trabecular formation is of a fine texture and others in close proximity in which it is coarse. "The growth force in such bones as indicated

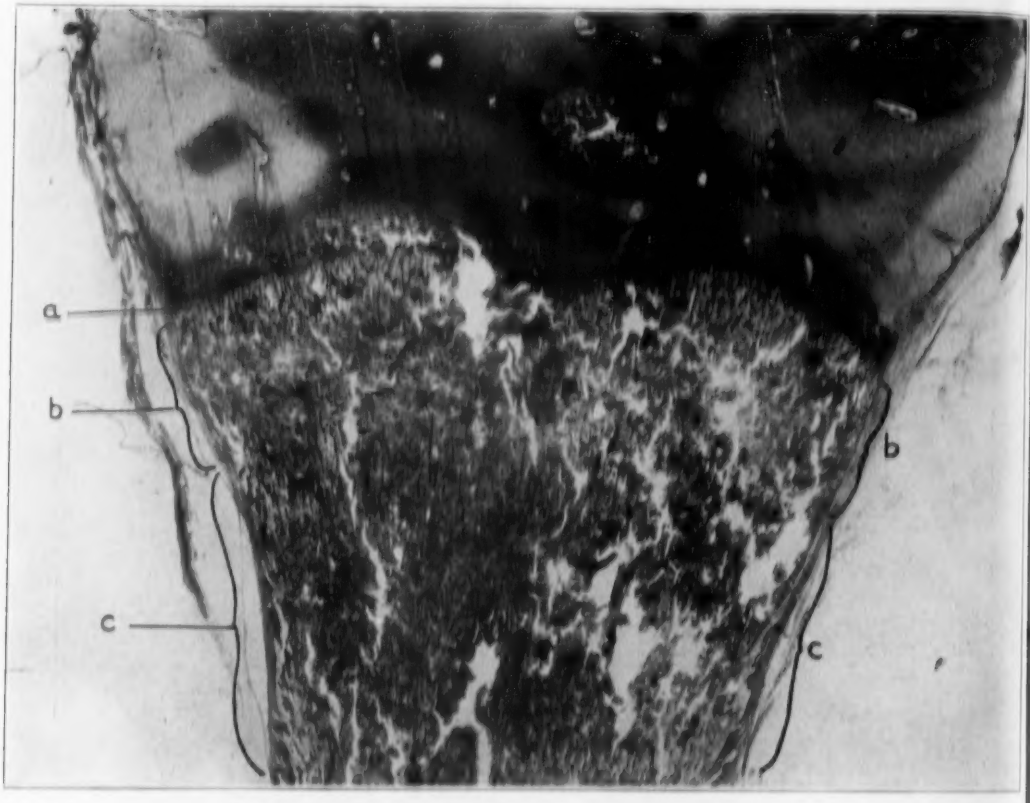

Fig. 5.—Photomicrograph of a section cut from the lower end of the left tibia in the case illustrated in figure 4 *B*. This illustrates a diminished osteoblastic activity, as shown by the abrupt diminution in the number of trabeculae in approaching zone *b* from zone *c*. In zone *c* the trabeculae are normal in size and distribution. In zone *b* the trabeculae are relatively few in number, which seems to explain the rarefaction seen by the x-rays at the ends of the bone shown in figure 4 *B*. There is very little lime salt at the metaphysis at *a*, nor is there any evidence of a deposit of lime salt at the lower metaphyses of the tibiae in the roentgenogram.

by the variation in architecture must have been over a long period in the state of oscillation, now halting and now going forward again, now as the result of a disturbed relation between supply and demand, forming one kind of product, now another."

Keeping in mind these observations, one cannot exclude the thought that widening of the zone of provisional calcification and even submetaphysial rarefaction may not be due to local action by the spirochetes, but to the systemic effect of the disease on the blood. It is well known that infants with congenital syphilis frequently have secondary anemia. It is not impossible that severe anemia in certain cases might be a contributory factor in the production of such changes.

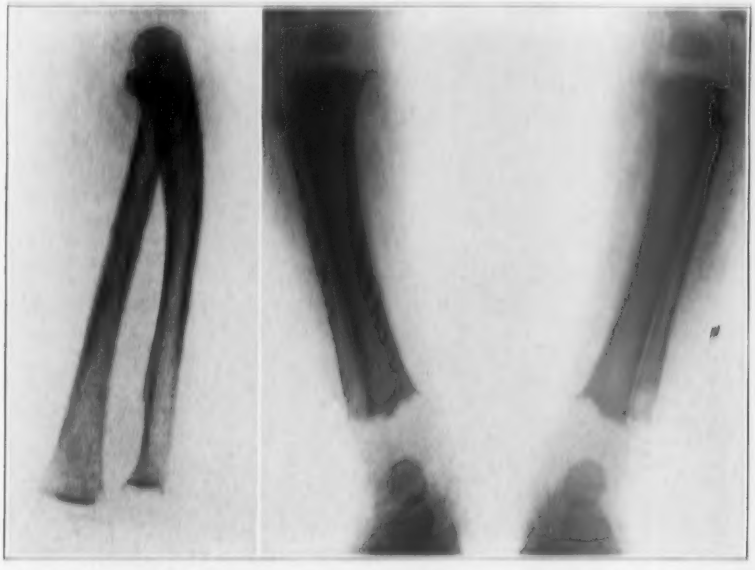

Fig. 6.—Bones of the left forearm and leg of an infant, aged 3 months, with florid syphilis. Death resulted from syphilitic nephritis. The distal end of the ulna shows a good example of moderate zigzag metaphysis. The distal ends of the tibiae and fibulae show marked zigzag or saw-tooth metaphyses. In addition, there are foci of rarefaction at the distal end of the radius and the proximal ends of both tibiae. The significance of the lesion at the distal end of the ulna, which is seen best with the reading glass, is not generally appreciated. It is often attributed to rickets. The control picture, the distal end of the radius with the foci of rarefaction, confirms the diagnosis.

The histopathologic explanation of the widened zone of provisional calcification has already been given. Next in order is the submetaphysial zone of rarefaction. When the rarefied submetaphysial zone is apparent in the x-ray picture, the zone of provisional calcification is not so wide

as when the latter occurs alone, but it may be more striking by virtue of its contrast to the contiguous zone of rarefaction.

The submetaphysial rarefaction is visible on the x-ray picture because of the deficient subchondral formation of spongiosa due either to a diminution in the number of new trabeculae or to their immature development (fig. 5). The lessened number of trabeculae is probably due to the fact that osteoblastic activity has not ceased with sufficient

Fig. 7.—Photomicrograph of greater magnification of the rectangular zone within the broken line in figure 3, showing enlarged cartilage canals containing connective tissue. A spur of calcified intercellular ground substance *b* extends along the cartilage canal, *bb*, which accounts for the bud on the metaphysis. At *c* is a focus of connective tissue; *d* is the dense deposit of lime salt from which the spurs arise.

abruptness entirely to prevent vascular loops from the shaft from converting calcified ground substance into bone. The trabeculae thus formed are relatively few as compared with normal bone and are thin because the defective osteoblasts have not been able entirely to complete their task.

In addition, in certain cases there is probably excessive resorption. Whether or not this is due to the activity of the osteoclast has not been absolutely established; at any rate, there is sufficient resorption of the trabeculae to show rarefaction by x-ray pictures.

Advanced Stages.—There is a more advanced stage of the previous lesion in which the roentgenologist can usually make an unequivocal diagnosis of osseous syphilis in the presence of a negative serology and

Fig. 8.—Photomicrograph of the costochondral junction of a syphilitic infant, aged 10 weeks, showing tongues of cartilage cells and remains of cartilage matrix well down in the shaft at *b*, which is characteristic of osseous syphilis in early infancy. *a* indicates the generating portion of the proliferative cartilage; *b*, cartilage cells and matrix well down in the shaft, and *c*, normal trabeculae.

a history of a negative physical examination. The so-called zigzag (fig. 6) or saw-tooth metaphysis type of lesion is not uncommon, especially if the roentgenologist examines the film with a reading glass. As opposed to the lesions previously described, these might be called active or specific lesions, since they are seen only when connective tissue is present and active resorption comes into play. One should be warned

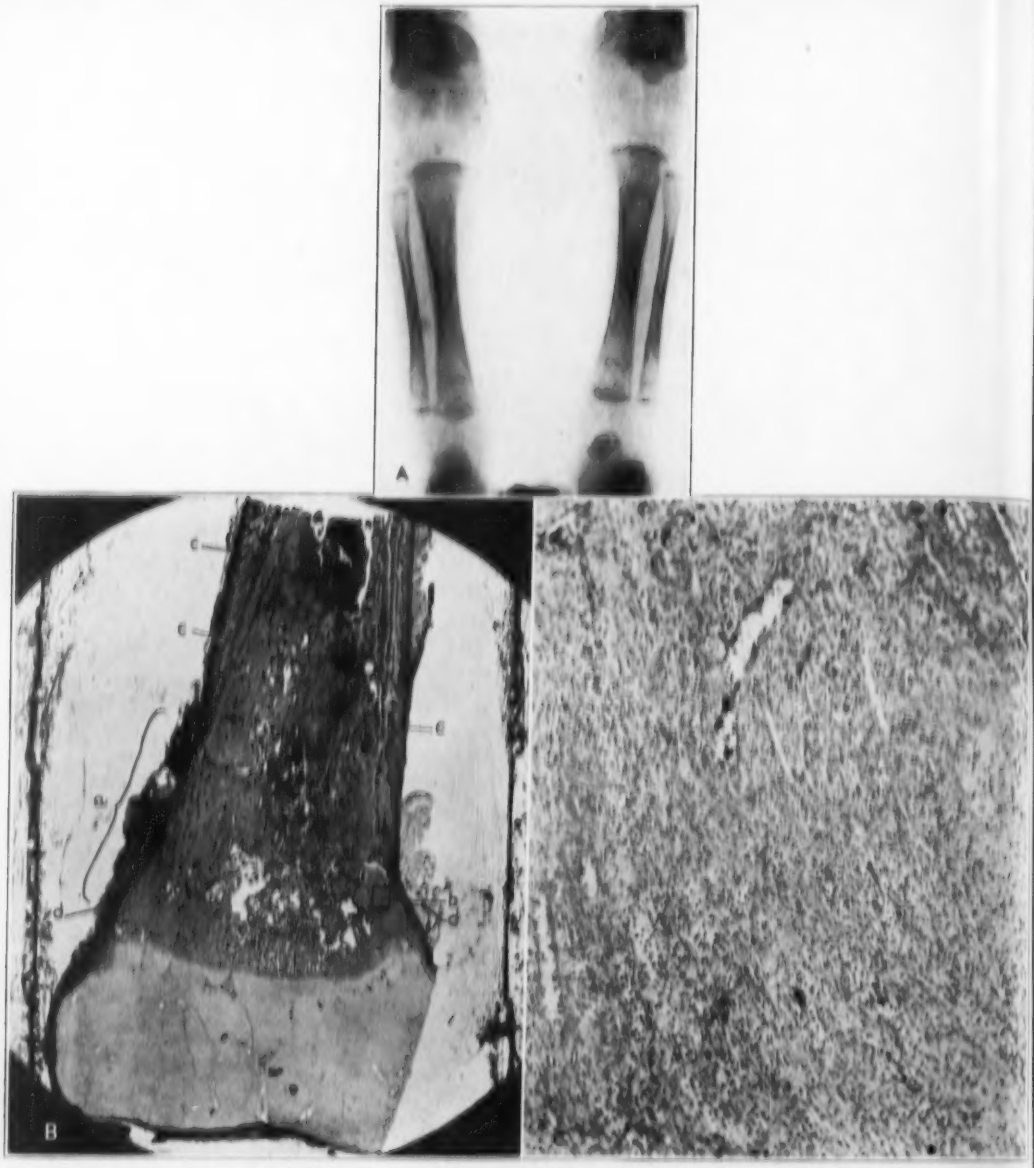

Fig. 9.—*A*, a syphilitic infant died at the age of 8 weeks. The roentgenogram shows spotty areas of rarefaction at the distal ends of the femora and the proximal and distal ends of the tibiae and fibulae. An unusually broad zone of submetaphysial rarefaction, 12 mm., in its longitudinal axis, is seen at both ends of both tibiae; it is somewhat less marked at both ends of the fibulae. The metaphyses seem accentuated, but this is largely by contrast with the contiguous rarefied zone. The periosteal layering present on both inner and outer aspects of the tibiae and to a lesser extent on the fibulae is not demonstrable by the x-rays along the shaft over the before mentioned rarefied zone. *B*, photomicrograph of the upper end of the tibia shown in *A*. The zone *a*, which runs transversely across the shaft, corresponds to the rarefied zone in *A*, which is made up largely of connective tissue. This casts a faint roentgen shadow owing to a great scarcity of trabeculae. The area marked *b*, made up entirely of connective tissue, is shown in a high power photomicrograph in *C*. The areas *d*, composed almost entirely of connective tissue, show as foci of almost complete rarefaction at the inner and outer aspects of the shaft where it abuts the upper metaphysis. At *c*, subperiosteal new formation of bone is shown. *C*, high power photomicrograph of area marked *b* in *B*, showing connective tissue with complete absence of trabeculae.

Fig. 10.—*A*, proximal end of the left tibia of an infant, aged 2½ months, with florid syphilis, who died of secondary infection after three weeks of vigorous therapy. *a* represents connective tissue in which are seen young trabeculae of new bone. Mesial to the broken line *c* is a large area of connective tissue with few trabeculae. On the mesial aspect within zone *b* there is a large amount of new bone formation. Compare zone *d* of the formation of new bone with *f* of old bone. *B*, high power photomicrograph of area *a* in *A*, showing new bone trabeculae in a field of connective tissue. *a* denotes connective tissue; *b*, formation of new bone.

against accepting the presence of one or possibly two minute spurs or buds shown on the metaphyses by the x-rays as evidence of syphilis, since they also occur in rickets. True syphilitic types show a definite saw-tooth edge, but even in these types cupping similar to that seen in rickets may be present. Saw-tooth metaphyses are the first evidence of lawlessness of growth, so characteristic of the active stage

Fig. 11.—Lower extremities of an infant, aged 2½ months, with positive serology and frank clinical signs of congenital syphilis. There are foci of rarefaction at the inner and outer aspects of both ends of the tibiae, with loss of the cortex. In addition, there is broadening of both ends of the fibulae, with submetaphysial rarefaction at the distal ends and periosteal layering of all long bones of this film.

of syphilis, concerning which there has been so much controversy. The whole may be explained on the basis of a disruption of the adjustment seen in normal rapidly growing bone between the proliferation of cartilage, the apposition of bone and the destruction of such waste material as unused cartilage cells and unused calcified intercellular ground sub-

stance. The cause is to be found in local circulatory disturbance which if prolonged always causes the formation of connective tissue and excessive resorption.

The irregular saw-tooth or serrated edge is visible on the x-ray picture only on its epiphysial side, i. e., the surface toward the joint, because of the transparent background. The buds toward the epiphyses

Fig. 12.—An infant, aged 4 months, showed frank clinical manifestations, syphilitic nephritis and positive serology. There is advanced submetaphysial rarefaction of the proximal end of the tibia. The metaphysis, which is thickened, is only attached to the shaft by a minimum amount of trabecular structure. The metaphysis is in the stage just before separation; in fact, a lateral view might disclose a forward or a backward shifting of the metaphysis with its epiphysial cartilage. Rarefaction is also present at the distal end of the tibia as well as at the proximal and distal ends of the fibula.

are caused by tongues of calcified intracellular ground substance which project out from the widened calcified zone between the columnar cartilage cells, especially about the vessels of the larger cartilage canals, and may even invade the resting cartilage (figs. 3 and 7). These larger vessels of the cartilage canals, probably because of their size, have preserved their integrity and are the chief vascular communication between epiphyses and diaphyses. Since these buds are heavily calcified, they show readily by the x-rays. The tonguelike protrusions toward the diaphyses away from the joint are usually made up of groups of columnar cartilage cells which either because of excessive growth or because of diminished

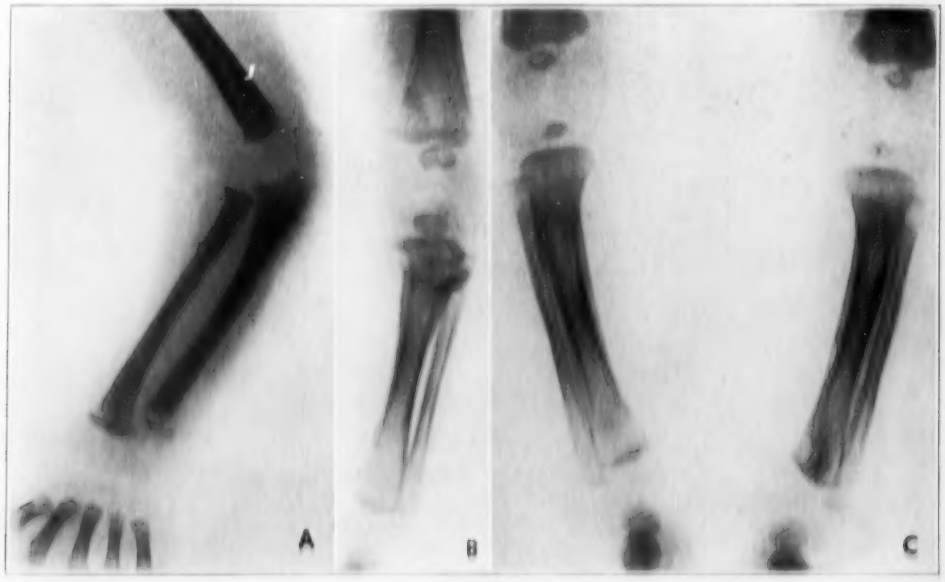

Fig. 13.—*A*, a syphilitic infant, aged 7 weeks, showed lateral displacement of the distal fragment of the ulna. *B*, a syphilitic infant, aged 2 months, showed a break entirely across the tibia at its proximal end with impaction of the proximal on the distal fragment. *C*, an infant, aged 47 days, showed frank clinical manifestations and pseudoparalysis of the right arm and leg. Impaction and angulation of the distal fragment of the left tibia are shown.

osteoclastic and osteoblastic activity have piled up at the epiphysial-diaphysial junction and have invaded the diaphysis at its weakest points (fig. 8). Since they seldom contain lime salts these columns of cartilage cells are not often demonstrable by the x-rays.

If the cartilage canals are extremely broad and invade the diaphysis, tongues of calcified intracellular ground substance will occasionally be seen along the walls of these canals well down into the bone marrow. Provisional calcification and subsequent ossification may proceed around

some of the vertical vessels that unite the epiphyses and the diaphyses which will result in epiphysial and diaphysial projections depending on the point of ossification. The connective tissue in the cartilage canals in congenital syphilis proliferates most abundantly as the canal approaches the metaphysis. This results in a marked dilatation of the canals at the metaphysis, and in consequence groups of columnar cartilage cells and areas of calcified intracellular ground substance become surrounded with connective tissue.

This proliferative connective tissue possesses the capacity of metaplastic formation of bone, and we have seen fine young spicules of bone

Fig. 14.—Right arm of an infant, aged 3 months, with frank clinical manifestations and positive serology. The lower end of the ulna has been entirely resorbed, while the lower end of the radius shows only a faint zone of submetaphysial rarefaction. The bones of the same extremity rarely show lesions in the same stages of the disease. Osteochondritis is present at the distal end of the humerus, with marked "periosteal cloaking" with periosteal layering of both the radius and the ulna.

in the submetaphysial connective tissue which can be interpreted only as a sign of healing.

German and Scandinavian pathologists have stressed the inflammatory nature of these lesions, and have devoted a good deal of argument to the question as to the origin of the so-called granulation tissue which they believe is of a specific character. They infer that the presence of this so-called specific granulation tissue is a large factor in the causation

of "epiphysial separation" as well as the destruction of the ends of long bones seen in severe cases. Some investigators believe that this tissue arises largely from the cartilage canals, others from the metaphyses, and one stresses the importance of the periosteum in the production of specific granulation tissue. The importance of the derivation of the connective tissue has not greatly impressed me.

Considerable doubt has arisen in my mind after examining the microscopic sections whether this is a specific inflammatory tissue. It is my impression that it is connective tissue which may grow wherever there is a plentiful supply of blood. From an examination of the

Fig. 15.—An infant, aged 2 months, showed frank clinical manifestations, positive serology and a cellular increase in the cerebrospinal fluid. The entire radius and ulna show involvement, osteochondritis, osteitis and osteomyelitis; however, in this instance these descriptive terms probably indicate only resorption of various parts of the ends of the bone as well as the shaft and its cortex, the replacement by connective tissue and the formation of new bone at the end of the metaphyses as well as along the shaft under the periosteum. The humerus presents a somewhat similar picture of a less severe type. Even the ends of the metacarpal bones are enlarged and rarefied.

material, it would also seem likely that the connective tissue is largely reparative and appears whenever there is a complete failure of osteogenesis or abnormal resorption. To be sure, connective tissue is seen in the enlarged cartilage canals, but the chief blood vessels connecting the shaft with the epiphyses are in the cartilage canals. I have

observed this connective tissue in the zone of cleavage of separated epiphyses and in the wide rarefied zones demonstrated by the roentgen rays at the proximal and distal ends of the bone (fig. 9) where the trabeculae were few and far between, and have seen young trabeculae in the connective tissue of an osteomyelitic lesion of the proximal end of the tibia (fig. 10).

One receives the impression that certain pathologists have endeavored to make the interpretation of lesions at the epiphysial-diaphysial junction

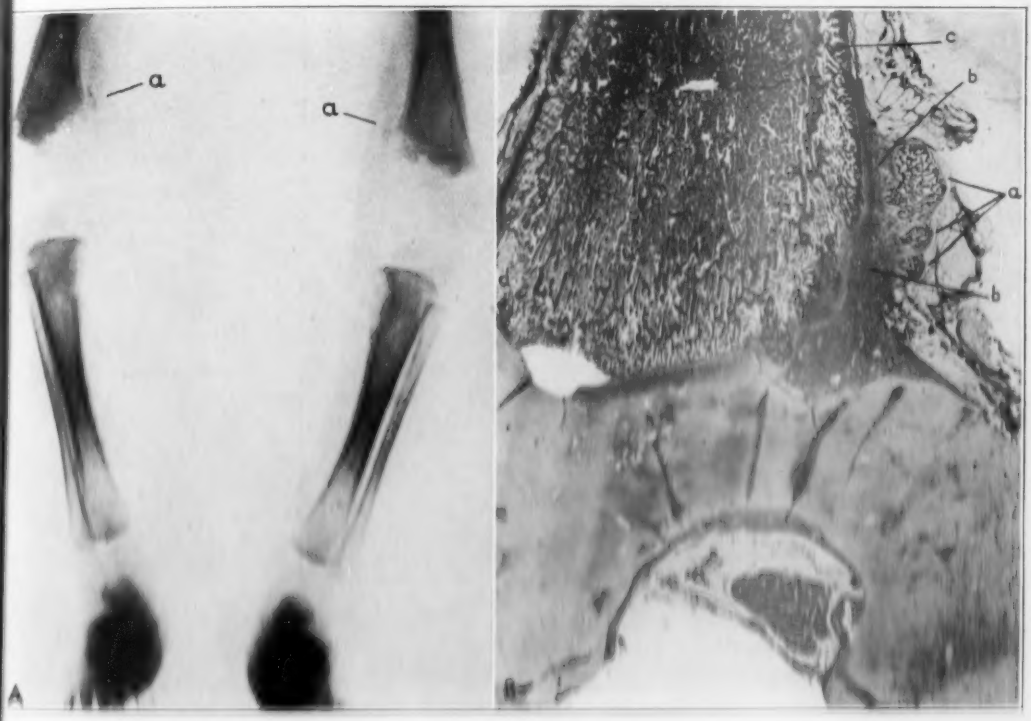

Fig. 16.—*A*, an infant, aged 6 weeks, showed frank syphilis and positive serology, with marked osteochondritis at the distal ends of both femora manifested by irregular areas of resorption. The upper quarters of the tibiae at the mesial aspect show a loss of the cortices and rarefaction of the shaft (osteomyelitis). Both tibiae and femora show periosteal layering. At *a* there is a small "fragment" of bone apparently entirely separated from the shaft, which is explained in *B*. *B*, the inner aspect of the lower end of the right femur. The three islands at *a* are trabeculae of the new bone which have formed in the connective tissue, *b*. Since connective tissue casts no shadow by the roentgen ray, these new groups of bone shown by the roentgen ray seem to be separated from the shaft of the bone. *d* is a focus of granulation tissue corresponding to the rarefied focus on the outer aspects of the metaphysis. *a* shows osteophytic growth of bone beneath the periosteum.

as obscure as possible, while in reality they represent merely various combinations of the picture produced by a disturbance of the normal relationship between the production and the resorption of bone.

When the x-ray picture shows rarefaction, connective tissue is present, and x-ray pictures of more advanced stages of osteochondritis are fairly representative in the order of severity of the amount of connective tissue present. Roentgenograms may show only foci of

Fig. 17.—Backward displacement and impaction of the distal metaphysis of the left femur in a syphilitic infant, aged 2 months. In addition, the film shows advanced osteochondritis of the proximal and distal ends of both bones of the leg and periosteal layering.

rarefaction at one or both angles of the epiphysial-diaphysial junction (fig. 11), a deep area of rarefaction between the shaft and epiphysial cartilage with only thin strands of cortex or trabecular structure uniting the proximal and distal fragment of the shaft (fig. 12) or a wide rarefied zone between the shaft and epiphysial end with displacement (fig. 13*A*) or impaction (fig. 13*B*) with or without angulation of the latter (fig. 13*C*). Not infrequently the x-ray picture shows that as

much as one fifth of the end of the shaft, usually the distal end, has apparently melted away, and only the proximal portion minus its "chewed off end" is seen in the roentgenogram (fig. 14). In the gross specimen the separated end, which casts no shadow or only a faint shadow on the x-ray film, consists of soft connective tissue, nongritty to the probe. Microscopically, it may show only connective tissue, but sometimes it contains degenerate mature trabeculae with diminished osteoblasts and a few young trabeculae. In both types the trabeculae are few as compared with the normal, and both because of their scarcity and because of their quality as compared with the normal offer an insuffi-

Fig. 18.—A syphilitic infant, aged 8 weeks, showed backward displacement of the epiphysial cartilage of the lower end of the femur, as indicated by the posterior shift of the center of ossification. Since there is no roentgen evidence of a backward displacement of the metaphysis as shown in figure 17, it would seem that the cartilage only had changed position, while the metaphysis, part of which is seen, remained attached to the shaft.

cient barrier to the passage of the x-rays, and hence cast either a very faint shadow or none (fig. 14). In all such lesions cartilage cells, marrow cells and red blood cells are sometimes found in varying numbers, but as these are not a factor in the production of the roentgen shadow they will be mentioned in detail only in the description of the individual sections. Occasionally the rarefaction will be more axial, seriously involving the shaft not only at the ends, but along the entire cortex, giving the picture of true osteomyelitis (fig. 15). Sometimes

small fragments at the broken-down distal end of the shaft will be seen to be apparently outside the periosteum, at least the roentgenogram creates the impression, but opportunity has been given me of showing by microscopic section that these isolated islands of trabecular structure are surrounded by a thickened layer of subperiosteal connective tissue

Fig. 19.—Photomicrograph of the lower end of the femur of an infant with florid syphilis, who was six weeks premature and 1 month of age. There is an advanced stage of lawless growth, characteristic of severe osseous syphilis. The cartilage and calcified ground substance have invaded the shaft and are present in quadruple the normal amount; proliferative cartilage cells are seen at *b* on the left and far down to *b* on the right. Between these cells there is a large amount of calcified intercellular ground substance, seen at *c* on the left and in large pools in *c* on the lower right side, which accounts for the brittleness of the bone and explains the beginning fracture at *d*. At *e* is connective tissue; at *a*, resting cartilage.

which is not calcified and hence casts no shadow on the roentgenogram (fig. 16).

"EPIPHYSIAL SEPARATION"

"Epiphysial separation" [4] as demonstrated by the x-rays is in reality usually a break in the end of the shaft (fig. 13 *A*). The smaller fragment remains attached to the epiphysial cartilage. Although the centers of ossification of greatest diagnostic interest in this connection are rarely present at the age period of osteochondritis, the center at the distal end of the femur is usually developed and, if epiphysial separation is present, demonstrates the anatomic lesion, as shown in figure 17. Rarely the x-ray film presents a picture of true epiphysial separation, as in figure 18.

Breaks in the diaphysis (epiphysial separation) are due to weakness in structure. If the steel netting were not placed in concrete, it would

Fig. 20.—A syphilitic infant, aged 10 weeks, showed a "punched out," osteomyelitic lesion in the lower half of the ulna characterized by a rarefied area involving the entire shaft for a distance of 1 cm., with a break in the cortex on both surfaces over which is layered a thin covering of supportive periosteal thickening.

crumble under severe strain; so it is with bone that is lacking in normal trabecular structure and overcharged with calcium, the latter having the value of concrete, the former of the steel netting. The normal trabecular structure fails to form. In its place may be found a stratum of weak, brittle, immature bone or a stratum composed of intercellular ground substance, some or a large part of which is calcified, groups of columnar cartilage cells, connective tissue and trabecular structure with diminished or entirely absent osteoblasts (fig. 19). In the normal growth of bone, calcified intercellular ground substance and cartilage cells which

4. Throughout this study the term "epiphyseal separation" will be used to denote diaphysial breaks. It is my impression that true epiphysial separation does occur in this disease, but rarely.

are not needed for trabecular formation are probably destroyed by osteoclasts. In syphilis they may not be destroyed. When the relationship between supply and demand is disturbed as in this disease, in the severest cases the metaphysis presents a chaotic appearance with groups of

Fig. 21.—An infant, aged 8 weeks, showed frank syphilis with pseudoparalysis and positive serology. There were symmetrical osteomyelitic lesions of the proximal mesial quarter of the tibiae, with a loss of cortex. This picture shows periosteal thickening of all the long bones. A peripheral rarefied zone can be seen in the tarsal bones.

undestroyed cartilage cells and calcified and uncalcified ground substance lying free and away from their normal position diaphysialward from the cartilage, often well down into the shaft. It is not the presence of connective tissue which invites separation, but the disorder which precedes

its growth (fig. 19). There seems to be a parallelism between destruction by osteoclasis and increase in connective tissue. This occasionally results in a zone of connective tissue and some undestroyed trabeculae separating the epiphysial cartilage from the normal portion of the shaft with the

Fig. 22.—Photomicrograph of one-half the proximal end of the left tibia shown in figure 21. The section was broken, as is shown at *a*. The entire area designated *b* is composed of connective tissue and is almost entirely lacking in trabeculae, which explains the rarefaction shown in figure 21. At b^2, the periosteum has disappeared.

periosteum acting as a splint to hold the two together. If separation has not already occurred in the "brittle stage" previously described, it may occur through this zone of connective tissue.

OSTEOMYELITIS

The circumscribed osteomyelitic lesions seem to correspond more to the type of inflammatory reaction, yet here again on section one notes that the trabeculae have been destroyed and replaced by connective

Fig. 23.—The mother was treated during pregnancy. At 5 months the mother and infant both gave positive serum reactions. At 13 months, when this picture was taken, no osseous lesions were present that could definitely be called syphilitic. At the proximal fifth of each tibia there is coarseness of trabeculation and irregularity in deposition of calcium, which does not suggest rickets. This zone could have marked the age level of a former osteomyelitic lesion in which the trabeculation had returned to normal. The tarsal bones have a central nucleus with a slightly rarefied periphery probably of no diagnostic value.

tissue. What causes the osteoclastic activity which produces these lesions is impossible to state. Other lesions such as are shown by the x-rays as cortical destruction are equally difficult to explain. Since both these lesions are beneath the periosteum it seems possible that in the horizontal growth of bone, which is of periosteal origin, there may be an osteogenic disturbance similar in some respects to that which occurs at the metaphysis.

Osteomyelitic lesions of several varieties can be definitely diagnosed syphilitic by the roentgen examination, especially if they are symmetrical. These are most frequently characterized by rarefied punched-out

Fig. 24.—An infant, aged 8 weeks, who was one month premature, was one of twins; the other one was stillborn. There is a double zone of rarefaction, which is best seen at the proximal end of the tibia. From above downward, there is a slightly accentuated metaphysis, then a zone of rarefaction of equal width, then a zone of normal bone, and finally a rarefied zone slightly wider than the upper rarefied zone. The fibula shows the same phenomenon at its proximal end. At the distal end of the tibia the zone can be seen only with a reading glass. The distal metaphysis of the femur is impacted on the shaft.

areas with thickened contiguous supportive periostitis (fig. 20) or punched-out areas shown by the x-rays with destruction of the contiguous cortex. The latter variety is usually seen in the upper inner aspect of the tibiae (figs. 21 and 22). There are a number of such examples in my collection. In one case the osteomyelitis had advanced transversely across the bone, resulting in an impaction of the proximal fragment on the shaft (fig. 13 *B*). These tibial lesions, which have been

mentioned by Wimberger, are seen only in congenital syphilis. They are so pathognomonic of the disease that in syphilitic infants too old to show the commoner lesions previously described I have always scrutinized the roentgenogram of the upper end of the tibia. Although this

Fig. 25.—An infant, aged 2½ months, had frank syphilis and positive serology. A definite layer of new bone is present on both aspects of the shafts of the femora on the mesial aspect of the tibia and on the outer aspects of the fibulae. In no instance does the periosteal layer approach within a centimeter of the metaphyses. The lesion is independent of the metaphyses.

is largely of academic interest, in several cases I have been rewarded by finding a definite irregularity of trabeculation in this region in both tibiae, which because of its symmetry and location can sometimes be considered in retrospect as healed syphilitic osteomyelitis (fig. 23).

Examples of various other types of lesions as shown by the roentgenogram will be described in the individual case reports.

The double zones of rarefaction seen at the ends of the long bones might be explained on the basis of arrest of the pathologic process and the formation of new bone from metaplasia of connective tissue followed by a relapse, as shown by a second zone of rarefaction (fig. 24).

Fig. 26.—An infant, aged 6 weeks, had frank syphilis, pseudoparalysis and positive serology. There was evidence of healing of the femura, with a marked production of new bone shown by the large clublike callous formation with the base at the ends of the bone and the apex in the middle of the shaft. The bones of the lower extremities show multiple foci of rarefaction due to resorption with substitution of connective tissue, which casts no roentgen shadow. The only suggestion of healing is at the proximal outer aspect of the right tibia where the subperiosteal production of bone is quite marked.

SUMMARY OF THE PATHOLOGY OF OSTEOCHONDRITIS

Osteogenic injury is manifested by diminished osteoblastic activity, alteration in the growth of cartilage and disturbance of normal resorption. This results in: (*a*) an overabundance of calcified intracellular ground substance which piles up at the metaphysis and (*b*) deficient

subchondral trabecular formation. These changes initiate abnormal resorption and eventually the production of connective tissue. Coincident with its appearance lawlessness of growth becomes apparent, and excessive osteoclastic activity becomes manifest with the resorption of varying portions of the metaphyses and diaphyses, which explains the various x-ray pictures of syphilitic osteochondritis.

Fig. 27.—An infant, aged 4½ months, had advanced optic neuritis, cerebrospinal syphilis, nystagmus and definite clinical manifestations, the serology of the blood and cerebrospinal fluid was positive. The roentgenogram shows marked thickening of all the long bones due to the subperiosteal production of new bone of sleevelike form, of which there can be distinctly seen three layers surrounding the almost vanished cortex of the femura and tibiae. Rarefaction of the proximal mesial aspects of tibiae with the absence of cortex of the left suggests in retrospect an incompletely healed symmetrical bilateral lesion, as shown in figures 16*A* and 21.

PERIOSTITIS

Since periostitis as the sole lesion is seldom found, it is of less diagnostic importance than osteochondritis, which frequently occurs without periostitis.

From the examination of x-ray and pathologic material, it may be assumed that there are three varieties of periosteal lesions:

1. Periosteal thickening, which occurs in an intact shaft independently of the lesions at the metaphysis, is generally thickest in the middle of the shaft, is not severe in character and is not associated with any demonstrable lesion of the spongiosa (fig. 25).

2. A supportive or healing type which is found over any break in the cortex of the shaft. It is present over osteomyelitic lesions and envelops the ends of the shaft in the healing stage in all marked cases of osteochondritis and increases with the recession of osteochondritis. It is the periostitis callosa of Schneider

Fig. 28.—Roentgenogram of the knee joints of a colored infant, aged 3 weeks, showing periosteal cloaking probably of rachitic origin. No history was obtainable as to the length of the pregnancy. The birth weight was 2 pounds and 12 ounces (1,247.38 Gm.). At 8 weeks the infant weighed 4 pounds (1,814.37 Gm.); at 12 weeks, 5 pounds (2,267.96 Gm.). Neither cod liver oil nor viosterol had ever been administered. Serologic tests of the mother gave negative results. Repeated serologic tests of the infant gave negative results. At the age of 11 weeks, the blood calcium was 9.2; the phosphorus, 5.5. Follow-up roentgenograms showed periosteal cloaking. Death occurred at the age of 16 weeks. Microscopic section of the bones showed rachitic changes.

and resembles the callus of healing fractures. It is usually thickest at the ends of the bones (fig. 26).

3. Ossifying periostitis or the hypertrophic osteoporosis of Pehu, which is the least common of all types is characterized by a tremendous thickening of the entire shaft of the bone which is due to a series of enveloping coatlike layers of newly formed bone which are separated from the shaft and from each other by a thin layer of spongy substance. I have not seen this variety earlier than the age of 4 months, in contrast to the first two types, which are common in the earlier months of life (fig. 27).

Some of the periosteal lesions are not unlike those of rickets. As soon as healing begins in severe rickets, lime salts are deposited in the diaphysial osteoid tissue, and the process may simulate syphilitic periostitis. I have an x-ray film of a colored premature nonsyphilitic infant 6 weeks of age, with repeated negative serologic tests, which shows a periosteal layering which on microscopic section proved to be of rachitic origin (fig. 28). If any lesion of the cortex can be demon-

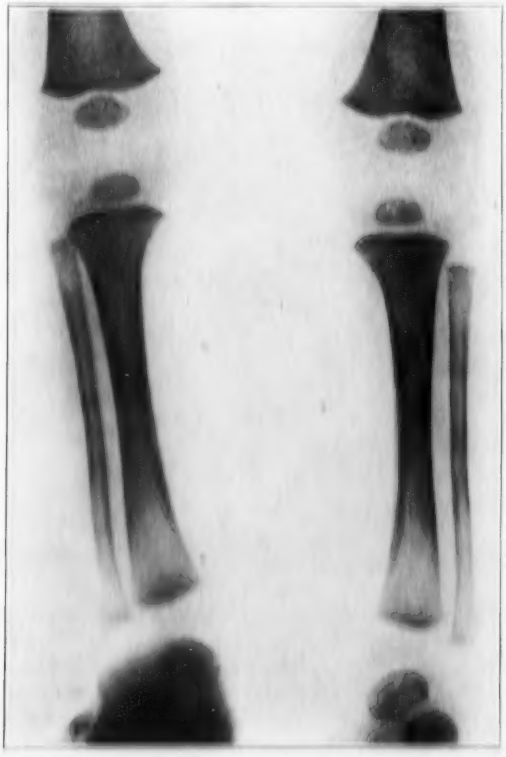

Fig. 29.—Roentgenogram of the lower extremities, showing what appears to be physiologic subperiosteal thickening along two thirds of the mesial surfaces of both tibiae. In addition, there is a central nucleus showing in two of the tarsal bones and a slight accentuation of all metaphyses. The film was taken of a marantic infant, aged 9½ weeks. The weight at birth was 7½ pounds (3,401.94 Gm.); at 9½ weeks, 8⅛ pounds (3,685.44 Gm.). Noguchi and Kahn tests of both the mother and the infant gave negative results.

strated by the x-rays under the periosteal cloaking, the lesion can be said to be syphilitic. Syphilitic and rachitic lesions can be associated even in the first months of life. In two of the patients with syphilitic osteochondritis under 3 months of age osteoid tissue was found on microscopic section. One should also keep in mind that rapidly growing

normal infants in the first months of life may show a fine periosteal shadow on the mesial aspect of the tibia, which the overenthusiastic observer might mistake for a pathologic lesion (fig. 29).

As previously mentioned, periostitis from a diagnostic point of view is less important than other lesions, since it seldom occurs alone. It is nearly always demonstrable when severe lesions of the epiphysis are present and can usually be discovered in syphilitic involvement of the long bones. Of interest, however, is the fact that it is the last lesion to disappear in healing, and may be demonstrated by the x-rays long after the lesions at the epiphysis have disappeared. My explanation of the histopathology of the different types of periosteal lesions as shown by the x-rays will be limited to the fundamental aspects, and no reference will be made to the modifications as mentioned by various authors.

The periosteal thickening that is seen bordering on the intact shaft is probably due to calcification of a thin layer of subperiosteal connective tissue. The calcification occurs, as in scurvy, from the presence of a layer or layers of osteophytes on the mesial surface of the periosteum, i. e., on the cellular or osteogenic layer.

Periostitis callosa is a healing phenomenon and varies in extent with the severity of the cortical lesion, from a slight but definitely limited elevation along the shaft to a clublike form in rapidly healing osteochondritis. This phenomenon is analogous to that which occurs in the healing of fractures. New bone is formed at a rapid rate, in part from the osteogenic layer of the periosteum and in part from metaplasia of connective tissue which has infiltrated and enveloped the original lesion. There is apparently nothing specific about this new bone formed in the healing of osteochondritis. I doubt whether a microscopic section could be differentiated from one removed from the thickened periosteum over a tuberculous osteomyelitis or the thickening which sometimes occurs over the sequestrum in any pyogenic osteomyelitis. A detailed description of healing as shown by the x-rays will be given in a separate study.

The form known as hypertrophic osteoporosis consists of layers of densely compact bone separated by marrow spaces. It would seem that this type of lesion is simply a reduplication of that of type 1. Successive layers of subperiosteal connective tissue are calcified one within the other, but at such a slow rate that rarefaction is occurring simultaneously with hypertrophy. The osteophytes produce the thick layer of compact bone, but resorption proceeding at a somewhat slower rate allows the formation of marrow spaces over each new layer of compact bone laid down. Eventually hypertrophy ceases; osteoclasts remove the excessive compact bone and the normal cortex, and spongiosa remain.

Pediatric Biographies

SAMUEL BARD
1742-1821

JOHN RUHRÄH, M.D.
BALTIMORE

Had it not been for the Rev. John McVicker, it is highly probabie that we would not know much about Samuel Bard, but fortunately in the "Domestic Narrative of the Life of Samuel Bard," he has left a considerable amount of interesting detail concerning one of the most remarkable medical characters of the Revolutionary Period (see "Pediatrics of the Past"). The grandfather, Peter Bard, left France after the revocation of the edict of Nantes, preferring to make the voyage to America rather than renounce his faith. Bard's father was named John, and he practiced medicine in Philadelphia. He was a deeply religious man, a trait which was passed on to Samuel, who was born on April 11, 1742. He was a bright boy, and it is related that his mother wrote to the school teacher: "If Peter does not know his lessons excuse him—if Sam, punish him for he can learn well." He was brought up in a manner totally different from that in vogue with the youth of today. At 70, he recalled that his father had punished him for shielding a servant boy, saying that he praised his generosity but punished his falsehood. Throughout his life, Bard's code was "Any fault may be excused but want of truth."

Bard was sent to King's College. At 19 he was on his way to Europe, but he was captured by the French and thrown into prison; he was afterward released through an old friend of his father, Benjamin Franklin. In 1762, he studied in London under Fothergill, and he met many of the celebrities of the day while he was reading medicine and attending St. Thomas' and Guys' Hospitals. Later he went to Edinburgh, where he studied chemistry under Cullen, anatomy under Monro and physics under Ferguson. Bard met many of the prominent men in Edinburgh, was admitted to the Medical Society where he read papers, and studied, besides medicine, French, Latin and drawing. He received his degree on May 13, 1765. The examinations were in Latin, and his friend Dr. Hope impugned his thesis which was entitled "De veribus opii," and was of sufficient merit to attract the attention of Haller. His

thesis was based on experiments made on his roommate, and he himself took the rôle of guinea-pig in turn and was "reduced to a state of torpor for several hours" through the use of ammonia.

His diploma is dated Sept. 6, 1765, and is signed by the two Robertsons, Rutherford, the two Monros, Whytt, Hope, Young, Hamilton, Cumming, Ferguson, Russell and Blair. The following winter he spent in London, and then returned to New York where he married his

SAMUEL BARD
1742-1821

beautiful cousin, Mary Bard. Within a year of his return he had organized a medical school which was united to King's College. At this time he was 28, but he was made professor of physic, a position he held for forty years, and for twenty years he was trustee and dean. This school conferred its first degrees in 1769, and Bard delivered the address which was entitled, "A Discourse upon the Duties of a Physician."

From John Johnston Esq^r

ENQUIRY

INTO THE

NATURE, CAUSE and CURE,

OF THE

ANGINA SUFFOCATIVA,

OR,

SORE THROAT DISTEMPER;

As it is commonly called by the Inhabitants of this City and Colony.

By SAMUEL BARD, M. D.
And Professor of Medicine in King's College,
NEW-YORK.

Is recte curaturus quem prima origo causæ non fefellerit. CELSUS.

NEW-YORK:
Printed by S. Inslee, and A. Car, at the
Printing-Office in Beaver-Street.

M,DCC,LXXI.

Title-page of Bard's Book on Diphtheria.

The period of the war brought him plenty of trouble. He left New York just before Howe entered, and when he returned he was regarded with suspicion. In spite of this his practice grew, and Washington chose him for his physician. Four of his six children died of malignant scarlet fever, and his wife's mind was temporarily deranged.

In 1788, he had a narrow escape from the so-called doctor's mob which sought to avenge the alleged grave robberies. When the unruly crowd approached his house, he had the doors and windows thrown open and he paraded in plain sight. The mob murmured and cursed, but his nerve won, and they passed on with acclamations of his innocence.

He was a prominent citizen, taking part in the intellectual pursuits, the philanthropies and the social life. In 1798, he removed to Hyde Park. In 1813, when the separation of Columbia College and its medical school took place, the regents of the University called Bard to the presidency. He held this position until his death, on May 24, 1821.

He was a pious soul, as were so many of his profession in those days, and he rose early to devote part of the day to religious reading and reflection. He wrote prayers, verse and numerous articles and addresses. His medical writings include a treatise on the use of cold in hemorrhage, a book on obstetrics and best of all, "Angina Suffocativa," which is dated 1771. It was the outcome of an epidemic of virulent diphtheria and is an American medical classic, nowadays of considerable rarity, but all the older medical libraries boast of a copy. When Brettonneau wrote his epoch-making work on diphtheria, Bard's essay was printed in translation, as a basic text.

Bard's little book is entitled "An Enquiry into the Nature, Cause, and Cure of the Angina Suffocativa or Sore Throat Distemper." One short excerpt must suffice:

> In general this disease was confined to children under ten years old, though some few grown persons, particularly women, (while it prevailed) had symptoms in some respects resembling it. Most of those who had it were observed to droop for several days before they were confined. And the first symptoms, in most instances, were a slightly inflamed and watery eye, a bloated and livid countenance, with a few red eruptions here and there upon the face, and in one case a small ulcer in the nose, whence oosed an ichor so sharp as to inflame and erode the upper lip. At the same time, or very soon after, such as could speak, complained of an uneasy sensation in the throat, but without any great soreness or pain. Upon examining it, the tonsils or almonds, appeared swelled and slightly inflamed, with a few white specks upon them, which, in some, increased so as to cover them all over with one general slough, and in a few the swelling was so great, as almost to close up the passage of the throat; but this, altho' a frequent symptom, did not invariably attend the disease; and some had all the other symptoms without it. The breath was either no ways offensive, or had only that kind of smell which is occasioned by worms; and the swallowing was very little, if at all, impeded.

These symptoms, with a slight fever at night, occurred in some for five or six days, without affecting their friends; in others a difficulty of breathing came on within twenty-four hours, especially in the time of sleep, and was often suddenly encreased to so great a degree as to threaten immediate suffocation. In general, however, it came on later, increased more gradually, and was not constant; but the patient would now and then enjoy an interval of an hour or two, in which he breathed with ease, and then again a laborious breathing would ensue, during which he seemed incapable of filling his lungs, as if the air was drawn through a too narrow passage.

This stage of the disease was attended with a very great and sudden prostration of strength; a very remarkable dry cough; and a peculiar change in the tone of the voice; not easily described, but so singular, that a person who had once heard it, could almost certainly know the disease again by hearing the patient cough or speak. In some the voice was almost entirely lost, and would continue very weak and low for several weeks after recovery. A constant fever attended this disease, but it was much more remarkable in the night than in the day time; and in some there was a remarkable remission towards morning. The pulse at the wrist was in general quick, soft and fluttering, though not very low, and it was remarkable, that at the same time the pulsations of the heart was rather strong and smart, then feeble. The heat was not very great, and the skin was commonly moist.

These symptoms continued for one, two, or three days. By that time it was usual for the pulse to be greatly increased in such as died; and these patients, though commonly somewhat from the beginning, now became much more so; yet even when the disorder was at the worst, they retained their senses, and would give distinct answers, when spoken to; although on being left to themselves, they lay for the most part in a lethargic situation, only raising up now and then to receive their drink. Great restlessness and jactation came on towards the end of the disease, the sick perpetually tossing from one side of the bed to the other, but they were still so comatous as to appear to be asleep, immediately upon changing their situation or posture. An universal languor and dejection were observed in their countenances; the swelling of the face subsided; a profuse sweat broke out about the head, neck and breast, particularly when asleep; a purging in several came on; the difficulty of breathing increased, so as to be frequently almost entirely obstructed, and the patient died apparently from suffocation. This commonly happened before the end of the fourth or fifth day; in several within thirty-six hours from the time the difficulty of breathing first came on. One child, however, lived under the circumstances to the eighth day; and the day before he died, his breath and what he coughed up, was somewhat offensive; but this was the only instance in which I could discover anything like a disagreeable smell, either from the breath or expectoration.

News and Comment

WHITE HOUSE CONFERENCE ON CHILD HEALTH AND PROTECTION

Preliminary Program of Final Session

SECTION I: MEDICAL SERVICE

Feb. 19, 20, 21, 1931, Washington, D. C.

SAMUEL McC. HAMILL, M.D., *Chairman*

COMMITTEE A: GROWTH AND DEVELOPMENT

Kenneth D. Blackfan, M.D., Chairman, Professor of Pediatrics, Harvard University Medical School

COMMITTEE B: PRENATAL AND MATERNAL CARE

Fred Lyman Adair, M.D., Chairman, Professor of Obstetrics and Gynecology, The University of Chicago

COMMITTEE C: MEDICAL CARE FOR CHILDREN

Philip Van Ingen, M.D., Chairman, Clinical Professor, Diseases of Children, Columbia University College of Physicians and Surgeons

Thursday, Feb. 19, 1931

9:00 a. m.: Opening Session for All Committees. Presiding, SAMUEL McC. HAMILL, M.D., Chairman of Section on Medical Service.

ADDRESS OF WELCOME: RAY LYMAN WILBUR, M.D., Chairman of the Conference.

COMMITTEE A: GROWTH AND DEVELOPMENT

Thursday, Feb. 19, 1931

9:30-11:00 a. m.: Presiding, HENRY F. HELMHOLZ, M.D., Professor of Pediatrics, University of Minnesota Graduate School of Medicine.

GENERAL CONSIDERATIONS: EDWIN BIDWELL WILSON, PH.D., Professor of Vital Statistics, Harvard School of Public Health.

Definition of terms, use of statistical procedure, heredity, the well born child, the significance of different age levels, the influence of climatic factors and socio-economic circumstances.

Discussion

11:00 a. m.-1:00 p. m.:

ANATOMICAL CONSIDERATIONS: RICHARD E. SCAMMON, PH.D., Professor of Anatomy, The University of Chicago.

The morphologic phases of growth which have a direct bearing on child health and protection. The growth of individual organ systems of the body. Anatomic considerations in respect to human types, body mechanics, differential growth and prematurity. The more common pathologic processes which modify growth. The sequence of events under normal circumstances.

Discussion

2:30-4:30 p. m.: Presiding, WALTER BRADFORD CANNON, M.D., Sc.D., Professor of Physiology, Harvard University Medical School.

PHYSIOLOGICAL CONSIDERATIONS: A. J. CARLSON, M.D., Sc.D., Professor of Physiology, The University of Chicago.

Development of the physiologic processes under normal conditions as well as in the presence of the more common pathologic disturbances. The physiology of each of the systems of the body. Physiologic adjustment, regulation of temperature, fatigue, sleep and prematurity as they directly bear on the practical problem of child health.

Discussion

8:00 p. m. (See Program of Committee C.: Medical Care for Children.)

Friday, Feb. 30, 1931

9:30 a. m. (See Program of Committee B.: Prenatal and Maternal Care; and Program of Committee C: Medical Care for Children.)

2:00-3:30 p. m.: Presiding, FRANK N. FREEMAN, PH.D., Professor of Educational Psychology, The University of Chicago.

APPRAISAL OF THE CHILD: I. PHYSICAL STATUS: T. WINGATE TODD, M.B., F.R.C.S., Professor of Anatomy, Western Reserve University School of Medicine.

The standards by which physical status is to be judged, and various other measurements of value not acceptable as standards, considered critically. Appraisal of the individual child with special reference to methods of examination and observations of significance at different ages. Application to groups of children.

Discussion

3:30-5:00 p. m.:

II. MENTAL STATUS: DOUGLAS A. THOM, M.D., Director, Division for Mental Hygiene, Massachusetts Department of Mental Diseases.

The development of intelligence and its measurement by tests of various types. The development of motor skill and language. The part played by emotion, by habit and by wise training in determining the behavior of children. Other subjects relating to mental development.

Discussion

8:00 p. m.: Presiding, JOHN R. MURLIN, PH.D., SC.D., Professor of Physiology, University of Rochester.

NUTRITION: LAFAYETTE B. MENDEL, PH.D., SC.D., Professor of Physiological Chemistry, Yale University.

Certain general considerations as to sources and supply of food substances as well as the individual food constituents, reviewed from the standpoint both of knowledge of the nature of these substances and of their practical significance in the diet of children.

Discussion

COMMITTEE B: PRENATAL AND MATERNAL CARE

Thursday, Feb. 19, 1931

9:30-11:30 a. m.: Presiding, FRED LYMAN ADAIR, M.D., Chairman of the Committee.

PRENATAL, MATERNAL AND EARLY INFANT CARE: JOHN OSBORN POLAK, M.D., Professor of Obstetrics and Gynecology, Long Island College Hospital School of Medicine.

Consideration of methods for consecutive, prenatal, intranatal and postnatal care in institutional and home cases of different racial groups in urban and rural communities.

Discussion to be opened by ADELAIDE BROWN, M.D., and EDWARD C. LYON, JR., M.D.

11:30 a. m.-12:30 p. m.:

INTERESTED ORGANIZATIONS: ROBERT D. MUSSEY, M.D., Professor of Obstetrics, University of Minnesota (Mayo Foundation).

Presentation of accomplishments and programs of various organizations of national scope having activities related to prenatal and maternal care.
Discussion to be opened by T. F. MURPHY, M.D., and CLARA E. HAYES, M.D.

2:00-5:30 p. m.: Presiding, FRED LYMAN ADAIR, M.D., Chairman of the Committee.

FACTORS AND CAUSES OF FETAL, EARLY INFANT AND MATERNAL MORBIDITY AND MORTALITY: HUGO EHRENFEST, M.D., Assistant Professor of Obstetrics and Gynecology, Washington University Medical School.

Consideration of antenatal causes and factors, intranatal causes and factors, postnatal causes and factors, morbidity and mortality statistics.

Discussion to be opened by FRED J. TAUSSIG, M.D., E. D. PLASS, M.D., and FRANK W. LYNCH, M.D.

8:00 p. m. (See Program of Committee C: Medical Care for Children.)

Friday, Feb. 20, 1931

9:00-10:15 a. m.: Presiding, FRED LYMAN ADAIR, M.D., Chairman of the Committee.

OBSTETRIC TEACHING AND EDUCATION OF MIDWIVES: JAMES ROBERT MCCORD, M.D., Professor of Obstetrics and Gynecology, Emory University.

So long as midwives are necessary in some sections of the country to care for certain racial groups, they must be trained in obstetric technic and work under medical supervision and control.

Discussion to be opened by RALPH W. LOBENSTEINE, M.D., and J. P. BOWDOIN, M.D.

10:15-11:30 a. m.:

OBSTETRIC TEACHING AND EDUCATION OF NURSES AND NURSING ATTENDANTS: GEORGE W. KOSMAK, M.D., Editor, *American Journal of Obstetrics and Gynecology.*

Report and recommendations relative to the teaching and education necessary to insure adequate nursing service to mothers and infants in homes and institutions by those engaged in this profession as institutional, public health or private duty nurses or in other fields of nursing activities.

Discussion to be opened by HAZEL CORBIN, R.N., and CALVINA MACDONALD, R.N.

11:30 a. m.-12:30 p. m.:

TEACHING AND EDUCATION OF THE LAITY AND SOCIAL WORKERS: ROBERT L. DENORMANDIE, M.D., Instructor in Obstetrics, Harvard University Medical School.

Report and recommendations regarding the subject matter and methods of instructing laymen. What, how and by whom the social workers should be taught about the problems that confront them in dealing with mothers and newly born infants.

Discussion to be opened by KATE MCMAHON and M. PIERCE RUCKER, M.D.

9:00 a. m.-12:30 p. m.: Presiding, LESLIE B. AREY, PH.D., Professor of Anatomy, Northwestern University Medical School.

BASIC SCIENCES AND THEIR RELATION TO MATERNAL AND FETAL PROBLEMS: LESLIE B. AREY, PH.D.

Report and recommendations of the committee relative to the part played by the basic sciences in the development of a program for child health and protection with suggestions for proper fields of research requiring stimulation and support.

Discussion to be opened by E. T. BELL, M.D., and ICIE G. MACY, PH.D.

2:00-5:30 p. m.: Presiding, FRED LYMAN ADAIR, M.D., Chairman of the Committee.

OBSTETRIC TEACHING AND EDUCATION OF PHYSICIANS:

I. CORRELATION OF INSTRUCTION IN THE BASIC SCIENCES WITH THAT IN OBSTETRICS FROM:

VIEWPOINT OF BASIC SCIENCES: LESLIE B. AREY, PH.D., Professor of Anatomy, Northwestern University Medical School.

VIEWPOINT OF OBSTETRICS: J. M. H. ROWLAND, M.D., Professor of Obstetrics, University of Maryland School of Medicine.

II. Undergraduate Education: Palmer Findley, M.D., President Central Association of Obstetrics and Gynecology.

III. Graduate Education: Rudolph W. Holmes, M.D., Associate Professor of Obstetrics, Northwestern University Medical School.

IV. Education and Other Obstetric Requirements for Granting Degree of Doctor of Medicine, Licensing to Practice and for Specialization: Walter T. Dannreuther, M.D., Professor of Gynecology, New York Post-Graduate Medical School.

Discussion to be opened by Reuben Peterson, M.D., and J. Whitridge Williams, M.D., Sc.D.

8:00 p. m. (See Program of Committee A: Growth and Development.)

COMMITTEE C: MEDICAL CARE FOR CHILDREN

Thursday, Feb. 19, 1931

9:30 a. m.-1:00 p. m.: Presiding, Harold K. Faber, M.D., Professor of Pediatrics, Stanford University School of Medicine.

Convalescent Care: Adrian V. S. Lambert, M.D., Chairman, Executive Committee on Convalescence, Welfare Council of New York City.

Types of institutional buildings; classes of patients received; length of stay; professional staff (services and responsibilities); staff for care, recreation and education; facilities for meeting emergencies; methods of admitting and discharging patients; relations between homes and referring agencies; conclusions and recommendations.

Foster Homes for Convalescence: Ida M. Cannon, R.N., Chief of Social Service, Massachusetts General Hospital.

Discussion to be opened by E. H. L. Corwin, Ph.D.

9:30 a. m.-1:00 p. m.: Presiding, Herbert B. Wilcox, M.D., Professor of Diseases of Children, Columbia University College of Physicians and Surgeons.

Psychiatry and Psychology: Bronson Crothers, M.D., Assistant Professor of Pediatrics, Harvard University Medical School, Neurologist to the Children's Hospital, Boston.

Report limited to discussion of duties and opportunities open to practitioners of medicine; confusion of field due to conflict of different groups; natural strength of the position of the pediatrician; relative simplicity of the problem rationally approached.

Discussion to be opened by Esther Loring Richards, M.D., Sc.D., and Borden S. Veeder, M.D.

9:30 a. m.-1:00 p. m.: Presiding, Lloyd T. Brown, M.D., Instructor in Orthopedic Surgery, Harvard University Medical School.

Orthopedics and Body Mechanics: Robert Bayley Osgood, M.D., Professor of Orthopedic Surgery, Harvard University Medical School.

Incidence of poor body mechanics; relation to functional health; what is being taught; what ought to be done in the education of physicians, physical therapists,

and school teachers; possibility of universal training of school children in principles of good body mechanics and in methods of correction of poor body mechanics; results to be expected; recommendations.

Discussion to be opened by JOHN BERTON CARNETT, M.D., and FRITZ B. TALBOT, M.D.

9:30 a. m.-1:00 p. m.: Presiding, EDNA L. FOLEY, R.N., D.Sc., Superintendent, Visiting Nurse Association of Chicago.

NURSING: STELLA GOOSTRAY, R.N., Secretary, National League of Nursing Education, Superintendent, School of Nursing, Children's Hospital, Boston.

The functions of the nurse in the care of children; personal qualifications and general education, preparation in general courses of nursing, postgraduate instruction in pediatric nursing, postgraduate course in public health nursing; adequacy of services rendered by nurses, as judged by physicians; public health nursing agencies in cities, small towns and rural areas; conclusions and recommendations.

Discussion

2:30-5:00 p. m.: Presiding, ISAAC A. ABT, M.D., Professor of Pediatrics, Northwestern University Medical School.

HOSPITALS AND DISPENSARIES (LANTERN SLIDES): CLIFFORD G. GRULEE, M.D., Clinical Professor of Pediatrics, Rush Medical College.

Distribution of hospitals and dispensaries accepting children; organization and extent of medical care for children; relation to pediatric education; preventive activities; facilities for convalescent care and for medical social service; organization for dental care and for correction of poor body mechanics; conclusions and recommendations.

Discussion to be opened by ADRIAN V. S. LAMBERT, M.D., IDA M. CANNON, R.N., PERCY R. HOWE, D.D.S., D.Sc., and ROBERT BAYLEY OSGOOD, M.D.

8:00 p. m.: Presiding, RAY LYMAN WILBUR, M.D., Chairman of the Conference.

PREVENTIVE MEASURES: PHILIP VAN INGEN, M.D., Chairman of the Committee.

Attitude of physicians, hospitals, dispensaries and health centers toward health examinations of children, vaccination against smallpox and immunization against diphtheria; attitude of parents toward these procedures.

REPORT ON A NATIONAL SURVEY TO DETERMINE THE EXTENT TO WHICH PREVENTIVE MEDICAL AND DENTAL SERVICES REACH PRESCHOOL CHILDREN (LANTERN SLIDES): GEORGE T. PALMER, DR.P.H., Director of Research, American Child Health Association.

1. In 158 cities based on approximately 85,000 families interviewed: Relative standing of states in proportion of preschool children having had health examinations, dental examinations, vaccination against smallpox and immunization against diphtheria; influence of economic status and age.

2. In rural areas in 42 states based on approximately 25,000 families interviewed: Relative standing of states in proportion of preschool children reached. Variations at different age levels. Geographic differences in hospital and home delivery service and attendance at birth. Accessibility of medical, dental and hospital service.

Conclusions and recommendations: SAMUEL McC. HAMILL, M.D., Chairman of the Section.

Discussion

Friday, Feb. 20, 1931

9:30 a. m.-12:30 p. m.: Presiding, PHILIP VAN INGEN, M.D., Chairman of the Committee.

PEDIATRIC EDUCATION (LANTERN SLIDES): BORDEN S. VEEDER, M.D., Professor of Clinical Pediatrics, Washington University School of Medicine.

Undergraduate instruction: adequacy of pediatric education as estimated by practicing physicians; facilities for and methods of teaching pediatrics; time devoted to pediatrics; instruction in certain subjects, such as the new-born, physical and mental development, public health and social factors; preventive measures; conclusions and recommendations. Postgraduate instruction: opportunities, extent and type; demand as shown by attendance, etc.; conclusions and recommendations.

Discussion to be opened by ALFRED STENGEL, M.D., ISAAC A. ABT, M.D., ADRIAN V. S. LAMBERT, M.D., ROBERT BAYLEY OSGOOD, M.D., BRONSON CROTHERS, M.D., and IDA M. CANNON, R.N.

2:15-5:00 p. m.: Presiding, EDITH M. BAKER, President, American Association of Hospital Social Workers.

MEDICAL SOCIAL SERVICE: IDA M. CANNON, R.N., Chief of Social Service, Massachusetts General Hospital.

Extent and distribution; functions of medical social service worker; integration of social and medical work; relation to public health nursing activities; adequacy of present personnel; number and training; training facilities; educational facilities; conclusions and recommendations.

Discussion to be opened by RICHARD M. SMITH, M.D., and PORTER LEE.

2:15-5:00 p. m.: Presiding, WILLIAM DEKLEINE, M.D., Medical Assistant to Vice Chairman, American Red Cross.

HEALTH CENTERS: J. H. MASON KNOX, JR., M.D., Chief, Bureau of Child Hygiene, State of Maryland Department of Health, and MRS. BERTHOLD STRAUSS, Vice-President, Community Health Center, Philadelphia.

Types of organization—county, city, public and private; clientele served; relation to other health agencies, hospitals and dispensaries; county health programs, gaps in the service; conclusions and recommendations.

RELATION OF THE NUTRITIONIST TO THE HEALTH PROGRAM: LUCY H. GILLETT, M.A., Superintendent, Nutrition Bureau Association for Improving the Condition of the Poor.

Discussion to be opened by IRA V. HISCOCK, M.D., MARY RIGGS NOBLE, M.D., and CHARLES FRANCIS WILINSKY, M.D.

2:15-5:00 p. m.: Presiding, LEROY M. S. MINER, M.D., D.M.D., Professor of Oral Surgery, Harvard University Dental Department.

DENTISTRY AND ORAL HYGIENE: PERCY R. HOWE, D.D.S., D.Sc.

Extent of dental caries in children (reliability of statistics); value of therapeutic work in prevention of caries; educational trends in corrective and preventive work; scientific basis of present theory and practice, part of the medical practitioner in prevention of dental caries; conclusions and recommendations.

Discussion to be opened by GUY S. MILLBERRY, D.D.S.

8:00 p. m. (See Program of Committee A: Growth and Development.)

Saturday, Feb. 21, 1931

9:30 a. m.: Joint Session for All Committees.

Presiding, RAY LYMAN WILBUR, M.D., Chairman of the Conference.

Summaries of Findings and Recommendations of the Committees:

1. Committee A: Growth and Development: KENNETH D. BLACKFAN, M.D., Chairman of the Committee.
2. Committee B: Prenatal and Maternal Care: FRED LYMAN ADAIR, M.D., Chairman of the Committee.
3. Committee C.: Medical Care for Children: PHILIP VAN INGEN, M.D., Chairman of the Committee.

These summaries are to indicate as far as is possible the gaps that exist in present procedures and suggestions as to how these gaps may be filled in order to bring about a well rounded nation-wide program for child health.

UNIVERSITY NEWS

The University of Vienna is offering courses in pediatrics under the supervision of Prof. Dr. Hamburger, beginning Monday, Feb. 16, and ending Feb. 28, 1931. These include many special general courses. The honorarium is 150 schillings.

Dr. John C. Gittings has been appointed lecturer in clinical pediatrics at the Johns Hopkins Medical School and a visiting physician to the Harriet Lane Home.

GENERAL

Drs. Comby and Cienfuegos Made Honorary Members of Pediatric Society.—Dr. J. J. Comby of Paris and E. Cienfuegos of San Diego, Chile, have been named honorary members of the pediatric society of Montevideo.

Hospital Appointments.—Dr. E. Aviragnet has retired from the service of the Hospital des Enfants-Malades of Paris because of having reached the age limit. He has been replaced by Dr. B. Weill-Hallé. The diphtheria service in this hospital has been taken over by Dr. H. Darré.

Dr. J. Huber has replaced Dr. H. Lemaire, who recently died, in the children's service at the Hospital Ambroise-Paré.

The following are named chiefs of clinic in the Hospice des Enfants-Assistés, Paris: Dr. Jean Chabrun, Dr. André Bohn, Dr. Fernand Benoist; and at the Hospital des Enfants-Malades, Dr. René Martin, Dr. Leon Caplin and Dr. Robert Liege, assistants.

American College of Physicians Holds Clinical Session.—The Fifteenth Annual Clinical Session of the American College of Physicians will be held in Baltimore on March 23 to 27, and in Washington, D. C., on March 28, 1931.

DEATHS

Dr. André Leri, associate professor at the Saint Louis Hospital, recently died in Paris, at the age of 55. He was a pupil of Marie and Babinski and was especially interested in neurologic pediatrics.

There recently died at Nancy, at the age of 73, Dr. Paul Simon, honorary professor of the medical clinic and previously a lecturer on the diseases of children in the university.

Henri Lemaire (1878-1930), prominent French pediatrician, died recently at the age of 52. Born at Orléans, he received his medical education in Paris and served his pediatric internship under Marfan. It was at this time that he conducted researches on serum sickness. During the war he served in Salonica and in collaboration with others wrote a monograph on malaria in Macedonia. From 1920 to 1926 he was the editor of *Le nourrisson* and made many contributions to French pediatric literature including those to "Un Précis d'hygiène et des maladies de la première enfance" which was published in 1930. He died following a long and painful illness.

Adolphe D'Espine (1845-1930), dean of French and Swiss pediatricians, died recently. Born at Geneva, he received his medical training in Paris and there became interested in pediatrics. His professional life was spent in Geneva, where he became professor of pediatrics in the University. In 1877, with Picot he published a manual on the diseases of children which enjoyed a wide popularity through numerous editions over a period of twenty years. Among his researches, the best known are those on scarlet fever.

On December 31, after a brief illness, Prof. Cesare Cattaneo of Milan, director of the pediatric clinic at that university and of the children's hospital there, and also president of the Italian Pediatric Society, died. Dr. Cattaneo was one of the outstanding pediatricians of Italy. He was well known for his many scientific contributions, and his passing will be a great loss.

Abstracts from Current Literature

Anatomy and Physiology

THERMIC REGULATION AND METABOLISM OF WATER. C. KAYSER, Ann. de physiol **4**:644 (Nov.) 1928.

Ablation of the cerebral hemispheres in the pigeon and cauterization of the dorsal surface of the thalamus cause loss of thermoregulation and polyuria. In the presence of a mild thalamic lesion polyuria disappears and thermoregulation is restored. There is complete parallelism between thermoregulation and the metabolism of water. In the rabbit piqûre always causes a fall of rectal temperature and a marked diminution in the production of heat. These effects appear with polyuria, and all disappear when the animal recovers. Operation causes the failure of chemical regulation, and thermoregulation fails in homothermous species when hydration equilibrium is upset.

KUGELMASS, New York.

WARMING AND THERMOGENESIS. A. MAYER and G. NICHITA, Ann. de physiol. **4**:648 (Nov.) 1928.

After cooling in a rubber sack placed in a mixture of ice and salt or after treatment by anesthetics, rabbits reestablish their temperature to the extent of 10 degrees C. (50 degrees F.) without increasing the exchanges, and even with a diminution of these by as much as from 30 to 50 per cent. When not anesthetized, the animal reacts to cold by muscular work, which entails an increase of lactic acid in the blood. This is the classic method of chemical regulation, but beyond it and masked by it there is an independent thermic mechanism.

KUGELMASS, New York.

CONGENITAL DEFORMITY OF THE POSTERIOR PART OF THE SHOULDER. OMBRÉDANNE, Presse méd. **38**:827 (June 18) 1930.

The author reports four cases of a peculiar deformity that consisted of bilateral fossae, corresponding to the posterior extremity of the outer border of the acromion process and running in a vertical direction when the arms were lifted to the horizontal position.

The deformity is familial, and the author attributes it to an ulcerative intrauterine condition rather than to amniotic adhesions, as has been suggested previously.

BIEKER, St. Petersburg, Fla.

MALFORMATIONS OF THE CERVICAL SPINE. L. DIAMANT-BERGER, R. PÉTRIGNANI and LIFCHITZ, Presse méd. **38**:833 (June 18) 1930.

A case is reported in which a cervical vertebral body without the posterior arc was interposed beneath the third cervical vertebra and the posterior arc, without the vertebral body, was seen above the first dorsal vertebra. A distinct depression could be felt above these anomalies. The total number of cervical vertebrae was considered as seven—six complete and two half vertebrae. The author explains the deformity as a faulty development of metameres by segmentary substitution.

BIEKER, St. Petersburg, Fla.

THE MOTOR FUNCTION OF THE INTESTINE IN INFANTILE BERIBERI. T. IZUMITA, Jahrb. f. Kinderh. **128**:199 (July) 1930.

Roentgenologic study of eleven infants with beriberi and four with no disease showed that normal human milk remained in the various portions of the intestine for the following number of hours:

	Small Intestine	Illeocecal Region	Colon	Entire Intestine
Beriberi	5	2½	12	20
Normal	6	2	12½	20½

CLAUSEN, Rochester.

THE SCHILLING LEUKOCYTE COUNT IN INFANCY. E. KOVÁCS, Jahrb. f. Kinderh. **128**:244 (July) 1930.

The literature contains few records of the Schilling differential count obtained during infancy. In twenty-five infants, from 2 weeks to 9 months of age, that were studied repeatedly, the author found no myelocytes, less than 1 per cent young forms of granulocytes and less than 6 per cent band nuclear forms. Feeding was without effect. In premature infants, the total white blood cell count was low; polymorphonuclears were increased; young forms were from 1 to 2 per cent and band nuclear forms from 6 to 20 per cent. In exudative diathesis, there was a moderate displacement to the left. In bronchitis there was no displacement to the left except when pneumonia developed subsequently (in from twenty-four to forty-eight hours).

CLAUSEN, Rochester.

THE GAS CONTENT OF UMBILICAL BLOOD BEFORE AND AFTER BIRTH AND THE GAS EXCHANGE IN THE PLACENTA. G. HASELHORST and K. STROMBERGER, Ztschr. f. Geburtsh. u. Gynäk. **98**:49, 1930.

During the last weeks of pregnancy the oxygen content of the blood of the umbilical artery averages about 0.84 per cent by volume, and that of the corresponding vein 3.97 per cent by volume. The corresponding values for the carbon dioxide content are 47.03 and 44.95 per cent by volume. Immediately after the beginning of respiration the oxygen content of the arterial blood rises to 3.4 per cent and that of the venous blood to 10.14 per cent. The corresponding values for the carbon dioxide content are 46.21 and 40.71 per cent. During birth the values vary within wide limits. Changes in the circulation account for the increase of the oxygen content during birth. The capacity of the fetal blood for oxygen at the time of birth averages about 21.9 per cent by volume. This is due to the high hemoglobin content of the infant's blood.

The authors states that they are engaged in studying various questions relative to fetal metabolism which this study has raised but has not answered.

ADAIR, Chicago.

Pathology, Bacteriology and Biochemistry

THE TRANSPARENCY OF LIVE AND DEAD ANIMAL TISSUE TO ULTRAVIOLET LIGHT. A. BACHEM and C. I. REED, Am. J. Physiol. **90**:600 (Nov.) 1929.

There is little difference in the transmission of ultraviolet light between living and dead tissue for the first few hours after death, provided the tissue is kept moist in Ringer's solution and is stretched. The coefficient for time-absorption changes with wavelength, but the scattering coefficient is almost constant.

KUGELMASS, New York.

CONGENITAL DIAPHRAGMATIC HERNIA: REPORT OF THREE CASES. H. J. EPSTEIN, M. J. & Rec. **132**:76 (July 16) 1930.

Cutler and Cooper classify congenital diaphragmatic hernia into three types: (1) true hernia with a sac covering the contents (due to a weakening in the

developed diaphragm), (2) false hernia without a sac and (3) eventration. Williams calls the first form congenital hernia, and the second, embryonic hernia. Eventration indicates the absence of muscle tissue in the diaphragm.

The embryology, pathology, symptoms and prognosis of the condition are described. Three case reports are given, two of which include the observations at autopsy.

WILLIAMSON, New Orleans.

THE ACTIVITY OF THE SPLEEN DURING ANAPHYLACTIC SHOCK. J. KRAFKA, JR.; F. D. MCCREA and E. VOGT, J. Physiol. **68**:292 (Nov.) 1929.

Four cats were sensitized to human serum (1 cc. given subcutaneously); two weeks later, two of the animals were given a provocative dose of human serum (under methenamine anesthesia); this caused a fall in blood pressure and respiratory embarrassment, but oncometric examination showed no change in the spleen. Similarily, the spleens of the other two cats, tested in vitro, showed no activity when treated with human serum, while a loop of isolated intestine from one of these animals showed marked contractions under the same conditions. Pilocarpine and atropine failed to produce any effect on the spleens of the hog and the calf, although epinephrine and barium chloride always produced contraction. Do these drugs really affect the parasympathetic system? Is a further study of the innervation of the spleen required? In anaphylaxis it appears that the spleen is not stimulated to contract and throw its blood into the general circulation.

KUGELMASS, New York.

THE MAIN BRANCHES OF THE CORONARY ARTERIES IN ACUTE RHEUMATIC CARDITIS. C. B. PERRY, Quart. J. Med. **23**:241 (April) 1930.

The discovery of severe intimal thickening in the main branches of the coronary arteries in a child with severe rheumatic carditis led the author to investigate the condition of these vessels in eight persons, all under 20 years of age, who died of rheumatic carditis. Sections were taken from the right and left coronary arteries near their origin, the right and left circumflex, and the left anterior and right posterior descending branches. From the pathologic study of this material, the author draws the following conclusions: 1. The main coronary arteries are usually affected in rheumatic carditis. 2. The lesion is a general panarteritis composed of: (*a*) intimal thickening which is more or less cellular, (*b*) degenerative and inflammatory lesions of the media and (*c*) inflammatory infiltration and fibrosis of the adventitia.

Clinical abstracts of the cases and excellent photomicrographs are presented.

BRADFORD, Rochester, N. Y.

THE VISCOSITY OF THE BLOOD IN HIGH BLOOD PRESSURE. I. HARRIS and G. MCLOUGHLIN, Quart. J. Med. **23**:451 (July) 1930.

In this paper are recorded the results of the authors' attempt to discover whether a relationship exists between high blood pressure and the viscosity of the blood. The viscosity was measured by means of the Hess viscosimeter, while the blood pressure was taken by means of the Riva-Rocci apparatus.

In the great majority of cases of high blood pressure the viscosity of the blood was found to be higher than normal. In a group of forty unselected cases of abnormally high pressure the average viscosity was found to be 7.715, or 2.265 units higher than the mean viscosity of a group of normal subjects. The viscosity was thought to be a causal or contributory factor in the hypertension.

The intake of large quantities of fluids lowered the viscosity of the blood and also the blood pressure, the viscosity varying inversely with the urinary output. The intramuscular injection of collosol sulphur lowered the blood pressure, but had no effect on the viscosity. The increase of viscosity in cases of hypertension

was not due to an increase in the carbon dioxide content of the blood or in the size or number of the red cells. In starvation the viscosity is increased.

BRADFORD, Rochester, N. Y.

ON THE PATHOGENICITY OF THE BACILLUS CALMETTE-GUÉRIN. MOTI MALKANI, Tubercle **11**:433 (July) 1930.

Malkani's work comprised the inoculation of forty-six animals (guinea-pigs and rabbits) with a culture of B C G obtained from the Pasteur Institute. Judged in the light of these experiments he concludes that B C G still shows virulence and, in spite of long cultivation on a bile-potato medium does not acquire an attenuation that distinguishes it from strains incompletely attenuated by other means. It sets up specific tuberculous lesions when experimentally inoculated in guinea-pigs and rabbits; depending on the degree of resistance that it meets in the animal organism, it either disappears from the system or leads to a process that terminates fatally in some cases.

SMITH, Ogden, Utah.

THE DURATION AND DEGREE OF IMMUNITY IN SUBJECTS VACCINATED WITH DIPHTHERIA ANATOXIN. G. RAMON and R. DEBRÉ, Presse méd. **38**:841 (June 21) 1930.

The results of immunization with diphtheria anatoxin are tabulated. The authors conclude that the number of positive immunizations is greater when anatoxin is used than with any other method—96 per cent of susceptible persons being immune after three injections—and that the antitoxic power of the blood is higher in these subjects.

BIEKER, St. Petersburg, Fla.

THE PHYSIOPATHOLOGIC AND CLINICAL INTERPRETATION OF SKIN ALLERGY IN PULMONARY TUBERCULOSIS. F. PARODI, Presse méd. **38**:845 (June 21) 1930.

Parodi believes that the degree of intensity of the Pirquet reaction depends on the neurotrophic state of the skin, and that the reaction itself is a reflex phenomenon of viscerotrophic origin. The reaction is influenced by physical agents capable of modifying the electrical charge of superficial tissue (ultraviolet, infrared, etc.), by chemical substances blocking nerve conduction (anesthetics) and by physiologic conditions (menstruation, etc.). The reaction is not specific and should not be given prognostic significance. However, a negative reaction that is limited to the cutaneous segment corresponding to the organ affected indicates an advanced lesion. The reaction varies widely in various cutaneous segments.

BIEKER, St. Petersburg, Fla.

THE OSCILLATION OF HUMAN TEMPERATURE. M. MICHALOWICZ, Rev. franç. de pédiat. **6**:137, 1930.

The author reports an interesting study in the physiologic variations in temperature. He found that exercise that fatigues produces a rise in temperature of as much as 0.6 degree C. (1.1 degree F.), followed by a gradual fall. Rapid movements not requiring a great deal of force likewise produce a rise, but the fall is much more rapid. The sun's rays also may cause elevation. The study was made with an electrothermal element. There is a discussion of the inaccuracies of the ordinary clinical thermometer. Numerous graphs are shown.

LESLIE, Evanston, Ill.

MODIFICATIONS OF THE OPSONIC INDEX IN CHILDREN INFECTED WITH MEASLES AND CHICKENPOX. G. A. PIANA, Pediatria **38**:827 (Aug. 1) 1930.

Piana reports observations on the influence of measles and chickenpox on the opsonic index for *Bacillus typhosus, Bacillus melitensis* and streptococcus. Observations were made from five to ten days after the height of the disease.

In measles the opsonic index was reduced for *B. typhosus*, normal for *B. melitensis* and increased for the streptococcus. In chickenpox the opsonic index was markedly increased for each of these three micro-organisms.

SIGNORELLI, New Orleans.

MULTIPLE NEVI ASSOCIATED WITH LOCALIZED OSSEOUS DYSTROPHY. A. CASAUBON and ELIAS CHAIT, Arch. argent. de pediat. **1**:382 (Sept.) 1930.

In an infant, aged 20 months, a large lymphangiomatous mass was located deep in the left pectoral muscle. The skin of the child showed numerous angiomas in various parts of the body. Both hands were almost a complete angiomatous mass of a wine red color. There were also skeletal changes and peculiar incurvations of several of the digits of both hands.

The disease is a disorder of the evolution of skeletal rudiments. This may be in the nature of aplasia—so-called ectromelia—or may be hypertrophic. The angiomatous manifestation is of this type.

SCHLUTZ, Chicago.

EXPERIMENTS WITH FILTRATE OF STAPHYLOCOCCUS CULTURES. GERTRUD REMÉ, Monatschr. f. Kinderh. **48**:70, 1930.

Remé used a filtrate of staphylococcus culture or toxin, made after the methods of the Dicks. The toxin behaved much like the streptococcus toxin of the Dicks.

She obtained positive reactions from intracutaneous inoculations in twenty-four hours in many cases. These tests were more like the pseudoreaction to a Schick test. She also noted that the positive reaction increased gradually until the sixth year and that after that time almost all subjects gave positive tests. This is in contrast to the age incidence for the Dick test.

Her experiments do not relate staphylococci to any definite disease.

GERSTLEY, Chicago.

THE CHLORIDE LEVEL AND CHLORIDE DISTRIBUTION IN THE BLOOD; ITS DEPENDENCE ON ACID-BASE EQUILIBRIUM. A. LANDAU; J. GLASS and S. KAMINER, Wien. Arch. f. inn. Med. **20**:375 (Sept.) 1930.

Determination of the plasma chlorides alone is not sufficient to form an opinion regarding the state of the blood chlorides. Simultaneous determination of the chlorides of both the plasma and the blood cells permits an estimate of the chloride content of the blood and also of any chloride shift between these two elements.

The physiologic change of this shift in the blood is small, but may become very large in pathologic conditions. The amplitude of these variations may be twice as great in the blood cells as in the plasma.

The determination of the chloride concentration in the blood cells, as well as the determination of the ratio between the chloride concentration in the blood cells and that in the plasma, is of great importance in the diagnosis of states of acidosis, especially those of renal origin and that arising in hypercapnia and anoxemia. The increase of blood chlorides above the normal limit of 1.95 Gm. per liter is found only in states of acidosis.

SCHLUTZ, Chicago.

THE PHOSPHATEMIC CURVE OF THE NORMAL AND THE RACHITIC ORGANISM. JOSEF WARKANY, Ztschr. f. Kinderh. **49**:191, 1930.

The phosphatemic curve in animals with hypervitaminosis is further above the fasting value than that in normal animals, but the return to the fasting value follows within seven or eight hours, independent of the amount of irradiated ergosterol given. The phosphorus excretion time is accordingly not influenced by the addition of vitamin D.

EMERSON, Boston.

THE APPEARANCE OF THE ELECTROCARDIOGRAM IN HEART LESIONS PRODUCED BY COD LIVER OIL TREATMENT. ERIK AGDUHR and NILS STENSTRÖM, Acta pædiat. **10**:167 (Aug. 18) 1930.

Pigs treated with cod liver oil were studied by methods similar to those previously used in other animal species. In one of the three pigs used infectious endocarditis developed; this animal should be eliminated from the analysis. Of the other two, one received 2 cc. of cod liver oil per day while the second received about twenty-five times as much. As in the other species, the authors report changes in the electrocardiogram and in the histology of the heart which they ascribe to the harmful effect of cod liver oil.

In calves treated with cod liver oil, the authors report functional and anatomic changes in the heart. The clinical behavior of one of these animals was striking. After it had been given cod liver oil for several weeks in irregular dosage, it was suddenly put on 150 cc. of oil a day at the age of 4 months. Two and a half weeks of this regimen brought on convulsions associated with a cardiac arrhythmia. With a change in diet it recovered its former state of good health, but a repetition of the treatment with cod liver oil brought out the same alarming train of symptoms. Shortly thereafter the animal was killed for anatomic study.

In an investigation of the absorption of cod liver oil by the digestive tube, lipoid balance determination were made in order to find out whether some of the peculiarities of the previously reported series of experiments might be explained by differences in the intestinal absorption. Cod liver oil fed to rats, rabbits and dogs is absorbed to the extent of from 95 to 98 per cent, and there is little difference between the results with pure oil and with the emulsion. On the other hand, when calves are placed on a high fat intake, they absorb only from 85 to 88 per cent.

The reviewer deplores the inadequacy of the controls in an investigation the importance of which calls for the utmost caution. In the experiments with pigs, all the animals received cod liver oil. In those with calves, two so-called controls received no oil, but in one of them infectious endocarditis developed, while the other was not subjected to histologic study.

McINTOSH, New York.

Nutrition

ELIMINATION OF FOREIGN PROTEIN (EGG-WHITE) IN WOMAN'S MILK. HARRY H. DONNALLY, J. Immunol. **19**:15, 1930.

Evidence of the elimination in the breast milk of food proteins ingested by lactating women has been clinical. Stuart's inability to confirm Shannon's experiments and conclusions casts grave doubt on their validity. Walzer's work on the absorption of egg makes it possible to determine when the lactating mother has unaltered egg protein in her blood stream. This constitutes a valuable guide as to the time to collect the breast milk for the study of its egg content. A human antiegg serum, such as serum F, once found, is available for a long time and offers considerable latitude to the experimenter. Among receptive skins moderate differences in reactivity are found. A specific test of great delicacy for egg-white is offered by the site in a reactive skin sensitized by human antiegg serum of high reagin content. Serum F sites may react to one part of egg-white in ten billon parts of salt solution or breast milk whey. A method for the preparation of concentrated breast milk whey for testing is presented, although its concentration may not be of great importance. The concentrated whey of breast milk obtained from three of eight women after the ingestion of raw egg, on an empty stomach and without other food gave the specific reaction for egg-white greater than the control, in sensitized sites in two normal recipients of each whey. Four recipients were utilized for the tests. By comparison of the skin reactions obtained with the breast milk whey, with those of known dilutions of egg-white, it is estimated that the concentration of egg-white in one of them was one part in a million, and in each

of the others one part in a billion. An unsuccessful attempt was made to sensitize a guinea-pig passively to egg-white, with 2.5 cc. of serum F intraperitoneally, as shown by the uterine strip method of Dale.

[ARCH. PATH.]

BRUCELLA ABORTUS IN CERTIFIED MILK. D. E. HALSEY, J. Infect. Dis. **46**:430, 1930.

The results of this investigation show that it is possible to detect *Brucella abortus* in market certified milk by plating methods. *B. abortus* was grown from 10 of 230 samples examined. The 10 positive samples were obtained from 3 of the 5 dairies studied. The highest number of organisms found was 8 per cubic centimeter of milk; the average for the 10 positive samples was 2 per cubic centimeter.

AUTHOR'S SUMMARY.

A COMPARATIVE STUDY OF LIQUID AND DRY MILK AS ANEMIA-PRODUCING DIETS. G. C. SUPPLEE, O. D. DOW, G. E. FLANIGAN and O. J. KAHLENBERG, J. Nutrition **2**:451 (May) 1930.

Milk desiccated by the revolving cylinder method contains approximately from two to five times more iron than the original liquid milk, the increase being due to the dissolution of iron from the metallic cylinders during the dry process. Dry milk contains an increment of copper only when the cylinders are relatively new.

The feeding of liquid milk exclusively to rats results in anemia, loss of weight and emaciation. The authors attempted to determine whether or not dry milk prevents the development of these symptoms. One group of rats received dry milk diluted to its original volume by the addition of distilled water, another group liquid milk, a third group dry milk reconstituted to one third of its original volume and a fourth group the stock ration containing grain mixture and whole milk. In the groups receiving dry milk and the stock ration the characteristic milk anemia did not develop. After 30, 60, 90 and 120 days on the diets described, a number of rats were killed in order to determine the amount and percentage of iron and copper in their bodies. It was found that there was a definite increase in the quantity of iron in the bodies of the rats that received dry milk as compared with those on the liquid milk diet. The content of iron in the body was highest, however, in those rats which received the stock ration, which contained considerably more iron than did the other diets.

Milk dried by the spray process does not contain an increment of iron and therefore does not prevent the development of nutritional anemia in the white rat.

LEWIS, New York.

THE EFFECT OF LOW CALCIUM, HIGH MAGNESIUM DIETS ON THE GROWTH AND METABOLISM OF CALVES. C. F. HUFFMAN, C. S. ROBINSON, O. B. WINTER and R. E. LARSON, J. Nutrition **2**:471 (May) 1930.

The purpose of this investigation was to determine in calves the effect of the addition of magnesium to a ration poor in calcium. Magnesium salts were added to the diet when signs of tetany appeared and it was found that instead of aggravating the condition, as had been maintained by some authors, the addition of magnesium phosphate in 50 Gm. amounts caused temporary relief. When signs of irritability reappeared, a larger amount of magnesium was administered and prompt disappearance of symptoms resulted. Analyses of the blood showed that the calcium content of the blood was restored to its normal level with the addition of magnesium to the diet, and fell to about 8.5 mg. per hundred cubic centimeters of serum when magnesium was discontinued. The addition of magnesium also caused a gain in growth and weight. Experiments on metabolism revealed that there was a marked improvement in the calcium and phosphorus balances when magnesium was given.

LEWIS, New York.

DIETARY REQUIREMENTS FOR FERTILITY AND LACTATION: FURTHER STUDIES OF THE RÔLE OF MILK FAT IN FERTILITY AND LACTATION. BARNETT SURE, J. Nutrition 2:485 (May) 1930.

Rats were placed on a basic ration consisting of whole wheat and powdered skimmed milk. This diet is satisfactory for growth but not adequate for lactation. Varying quantities of butter fat were added to this ration to determine its rôle in reproduction and in lactation. The rats receiving the largest quantity of butter fat, namely, 9 per cent, were found to be most fertile. In three groups of rats given rations that varied in butter fat by 2 per cent, it was noted that for every increase of 2 per cent in butter fat the efficiency of lactation was improved by 12 per cent. Diets of milk powder are not optimal for lactation as they are deficient in vitamin B.

LEWIS, New York.

THE EFFECT OF VARYING AMOUNTS OF MENHADEN OIL IN THE DIET ON THE COMPOSITION OF THE BODY FAT OF THE WHITE RAT: THE STORAGE OF HIGHLY UNSATURATED FATTY ACIDS. J. B. BROWN and S. G. MORRIS, J. Nutrition 2:509 (May) 1930.

Menhaden oil, which contains a number of highly unsaturated acids, was included in the diet of white rats in order to determine whether the composition of body fat would be altered. When the diet contained 30 per cent of Menhaden oil it was found that the body fat consisted of 17.2 per cent of highly unsaturated fatty acids as compared with 1.3 per cent in the control rats. The deposited unsaturated acids were even more unsaturated than those of the Menhaden oil. The authors offered two explanations for the increase in unsaturation of the fatty acids in the body: 1. The rat may metabolize the lower fatty acids which are less unsaturated, and thus the more unsaturated acids would be available for deposition in the body. 2. The highly unsaturated acids may be further desaturated in the body with the introduction of more double bonds.

LEWIS, New York.

INFANT FEEDING FOR THE GENERAL PRACTITIONER. MICHAEL SCHUMAN, M. J. & Rec. 132:109 (Aug. 6) 1930.

The author discusses infant feeding under three headings: breast feeding, mixed feeding and modified milk feeding. Under breast feeding he gives the reasons why every child should be nursed at the breast if possible, and advises intervals of three hours between nursings during the first few months and after that, intervals of four hours. Under the head of mixed feeding he says that if the infant is not gaining weight properly he should be weighed before and after nursing to find out how much breast milk he is getting; if the amount is insufficient he should be given a complementary feeding of diluted cow's milk. Under the heading of modified milk feeding Schuman says: 1. The average healthy infant requires in twenty-four hours twice as many ounces in milk as it weighs in pounds. 2. A healthy infant weighing less than 10 pounds (4.5 Kg.) requires 1 ounce (28.3 Gm.) of sugar in twenty-four hours and one over 10 pounds requires 1½ ounces (42.5 Gm.) of sugar. 3. An infant of average size should have at each feeding one-half ounce (14.1 Gm.) more than the number of months it is old. Schuman says that orange juice should be given at 2 months and breadstuffs at from 4 to 6 months.

WILLIAMSON, New Orleans.

VITAMIN D IN ERGOT OF RYE. E. MELLANBY, E. SURIE and D. C. HARRISON, Biochem. J. 23:710, 1929.

Puppies were made rachitic by a diet of bread, oatmeal or white flour, plus lean meat, separated milk powder, olive or peanut oil, dried yeast, orange juice and sodium chloride. The administration of from 2 to 5 Gm. of ergot daily prevented rickets, but the animals frequently refused food. The calcifying agent

could be extracted from the ergot by alcohol, was soluble in ether, withstood saponification and passed into the unsaponifiable fraction when the soaps were extracted with ether but not when petroleum ether was used. The amount present was not increased by exposing the grains to sunlight for twelve hours, but was slightly increased after one-half hour's exposure to a mercury vapor lamp. None was found in mushrooms, but a small amount was extracted from rye germ by light petroleum; the germ residue contained an anticalcifying factor.

KUGELMASS, New York.

METASTATIC CALCIFICATION: NOTES ON TWINS BORN SHORTLY AFTER AN ATTACK OF SMALL-POX IN THE MOTHER. J. PICKFORD MARSDEN, Brit. J. Child. Dis. **27**:193 (July-Sept.) 1930.

About a month after an attack of smallpox in the mother, female twins were born about one and a half months prematurely. Both infants were said to have presented at birth an eruption that was considered to be smallpox. A week later, when first seen by the author, one twin showed jaundice, but otherwise had normal skin. Three attempts to vaccinate both infants were unsuccessful. The other twin showed a fairly generalized eruption consisting of small punched-out ulcers covered with brownish or greenish scabs. Umbilical sepsis set in, followed by an abscess over the right scapula and jaundice. Then signs of tetany and scattered purpuric spots were noted, as well as a large number of small, hard, seedlike nodules, freely movable beneath the skin and scattered over the body. On the twenty-eighth day of life the child died. At postmortem examination the nodules proved to be underneath the true skin and varied in size from that of a grain of wheat to that of a small pea; on histologic and chemical examination, the chief constituent was found to be lime salts.

Metastatic calcification, originallly described by Virchow, is usually associated with withdrawal of calcium from the skeleton. In the present case the bony skeleton was normal, but there was considerable increase in the parathyroids which are known to have a close connection with calcium metabolism.

LANGMANN, New York.

CAROTENE AND VITAMIN A: THE ANTI-INFECTIVE ACTION OF CAROTENE. H. N. GREEN and E. MELLANBY, Brit. J. Exper. Path. **11**:81, 1930.

Tests on a specimen of carotin (melting point, 174 degrees) showed that in growing rats this substance had the property of conferring complete immunity to the development of spontaneous infection. In animals on a diet free from vitamin A and carotin, septic foci invariably developed and the animals died. When carotin was given in the food, the amount of protection conferred on the animals was generally proportional to the amount of carotin eaten. With the basal diet used in these experiments, 0.005 mg. of carotin gave only slight immunity and 0.01 mg. partial immunity, whereas 0.02 mg. and greater amounts gave complete or practically complete immunity.

AUTHORS' SUMMARY.

VITAMIN A AS AN ANTI-INFECTIVE AGENT. H. N. GREEN and E. MELLANBY, Brit. M. J. **2**:691 (Oct. 20) 1928.

Previous work on the susceptibility to infection of animals on a diet deficient in vitamin A has been inconclusive, owing to the fact that the diets were also deficient in vitamin D. The present authors maintained a large number of young rats on a diet deficient in vitamin A, but containing irradiated ergosterol as the source of vitamin D. Most of the 93 animals deficient in vitamin A died after from 58 to 169 days, and at autopsy practically all showed well marked infection of various organs. The lesions included: xerophthalmia, sublingual abscess, infection of the kidney and bladder and acute enteritis. Fifty control rats of the same age and weight which were kept for longer periods on the same diet, with the

addition of vitamin A (butter, cod liver oil or cabbage), showed no gross infective lesions. The authors suggest that the cessation of growth of animals in the absence of vitamin A is due to development of these infections, and that the function of vitamin A is that of an anti-infective agent.

KUGELMASS, New York.

BLOOD CHOLESTEROL IN RACHITIC INFANTS. LESNÉ, SYLVESTRE and ZIZINE, Bull. Soc. de pédiat. de Paris **27**:350 (July 9) 1929.

The average figures for the blood cholesterol in infants were 0.8 Gm. per liter for the first 2 months of life, and 1.2 Gm. per liter in infants from 3 to 18 months of age. The figures for breast-fed infants were slightly higher than those for artificially fed infants. Of twenty-seven infants with rickets only eight showed a slightly lower blood cholesterol than normal. Five infants with craniotabes showed a low blood cholesterol in every instance. The authors express the belief that infections and toxemias as well as functional disturbances of the liver and kidneys, which often occur in rachitic children, cause alterations in the cholesterol content of the blood. The important point in the pathogenesis of rickets is the failure of activation of the cholesterol in the skin as a result of the deficiency of actinic rays.

BENJAMIN, Montreal, Canada.

DETERMINATION OF THE BLOOD CHOLESTEROL IN RACHITIC CHILDREN. H. DORLENCOURT and C. SEÏSOFF, Bull. Soc. de pédiat. de Paris **27**:352 (July) 1929.

The authors found the figures for blood cholesterol to be higher in breast-fed than in artificially fed infants. There was little difference in the figures for somewhat older children as compared with those for adults; the blood cholesterol for children, 2 years of age, showed a difference of only 0.2 Gm. per liter as compared with that for adults. There was a lowered cholesterol content in the children with rickets. Eight infants with craniotabes, only one of whom also had marked thoracic rickets, showed low values for blood cholesterol. In healing rickets the blood cholesterol is the first substance to increase; this precedes the increase in blood phosphorus. In rickets there is a lowered cholesterol content, similar to that found in the course of many infectious diseases. This would tend to lend support to the theory that presupposes some infectious toxin in the pathogenesis of rickets.

BENJAMIN, Montreal, Canada.

DIETARY INDICATIONS IN INFANTS HAVING MUCOUS STOOLS. M. RIBADEAU-DUMAS, RENE MATHIEU and WILLEMIN, Bull. Soc. de pédiat. de Paris **27**:361 (July) 1929.

The authors discuss the composition of curds in infants' stools, and mention some experiments in vitro which they performed. They assume that mucus in the stomach is passed as mucus in the stools, a fact that Marfan said was questionable. They conclude that curds and mucus found in the stools of infants have little significance. The most important points to bear in mind in the treatment of infants with enteritis and mucous stools are to give them suitable and adequate feedings and to endeavor to have them gain weight consistently.

BENJAMIN, Montreal, Canada.

LOBSTEIN'S DISEASE IN AN INFANT (NORMAL BLOOD CALCIUM AS CONTRASTED WITH DIMINISHED LIME CONTENT OF THE BONES). E. LESNÉ, J. HUTINEL and G. DREYFUS-SÉE, Bull. Soc. de pédiat. de Paris **27**:377 (July) 1929.

In 1829 Lobstein described several cases of osteopsathyrosis the outstanding feature of which was the brittleness of the bones. Other observers have since added such signs as slate-blue sclerae and deafness to the clinical picture that one sees in this disease. The authors cite the case of a boy, aged 7 months, who

had a fracture of the femur at the age of 1 month and multiple fractures of the humeri, tibiae and ribs since then. The blood calcium was normal, and on a regimen which included the administration of irradiated ergosterol, calcium chloride and ultraviolet exposures it increased slightly. At autopsy the lungs showed consolidation. The sternum and some ribs as well as the thyroid gland were removed and compared with these tissues from a child of the same age who had also died of pneumonia but who was otherwise normal. There was a definite diminution in the fixed calcium in the tissues of the brittle-boned child as compared with those of the normal one, more marked in the specimens of the bone than in those of the thyroid. Histologically the thyroid showed a marked sclerosis and abnormal alveoli which contained a poorly stained colloid substance. It is interesting that although the calcium content of the bones was below normal even after the treatment mentioned, the blood calcium was normal and the healing of the fractured fragments took place as securely and as rapidly as in normal bones.

BENJAMIN, Montreal, Canada.

THE USE OF EVAPORATED MILK IN THE VOMITING DUE TO PYLOROSPASM IN INFANTS. MARCEL MAILLET, Bull. Soc. de pédiat. de Paris **27**:530 (Dec.) 1929.

Milk was evaporated to one-half its volume by slow boiling in a receptacle without a cover for a period of 110 to 120 minutes, with 3 per cent of sugar. This was fed to a large number of infants with pylorospasm in quantities somewhat larger than those of ordinary milk feedings. The results were good, the vomiting ceasing in a short time in every instance. A higher sugar content was used with good results in some of the infants who were athreptic. Milk evaporated only to two thirds of its volume was tried, but failed to stop the vomiting, which ceased only when the half evaporated milk was given. To avoid any condition that might be due to an insufficient intake of water, the infants were given boiled water between feedings. The author advises the administration of some fruit juice.

BENJAMIN, Montreal, Canada.

THE DISAPPEARANCE OF VITAMIN B IN GERMINATING SEEDS. J. HLAVATY, Compt. rend. Soc. de biol. **100**:587 (March 1) 1929.

Vetch seeds in an incubator show a progressive decrease of vitamin B up to the twenty-first day. Peas exhibit a similar loss in a similar condition. In both, when grown in ordinary soil, there is diminution up to the twenty-seventh day, when resynthesis seems to begin. Vitamin B does not disappear altogether from leguminous seeds up to the thirtieth day. These seeds have, therefore, a different nutrient value from that of cereals.

KUGELMASS, New York.

INFLUENCE OF ACIDITY ON FORMATION OF VITAMIN C. A. LUETTMERDING, Compt. rend. Soc. de biol. **100**:589 (March 1) 1929.

The development of vitamin C in wheat, oats and peas was tested in mediums of different p_H. This formation is accelerated in oats and wheat grains in acidified water, and is directly proportional to the concentration of acid in the solution. The formation of vitamin C in the cereals is allied to the process of germination. The vitamin disappears quickly in the macerated seeds.

KUGELMASS, New York.

SUGARS IN THE FEEDING OF NURSING INFANTS IN NORMAL AND IN PATHOLOGIC CONDITIONS. GIOVANNI BATTISTINI, Clin. pediat. **12**:311 (April) 1930.

The author reports a series of experiments carried on over periods varying from seven to thirty-five days during which groups of infants were fed various types of sugars (sucrose, inverted sugar, lactose and dextrose) with the aim of

establishing the point of tolerance and of alimentary utilization of each and of mixtures of two or more of them.

Daily observations were made and noted. From these the author concludes that the most important factors to be considered in establishing the superiority and choice of sugars in the feeding of infants is the general condition of the patient and particularly the condition of the alimentary system. The evidence deduced led him to believe that, all factors being equal, sucrose is the best tolerated and gives the best results of all sugars tested.

He established the laxative effect of inverted sugars, the action of which he believes resembles that of lactose given in large doses. He is convinced also that in cases of habitual vomiting in infants, large quantities of this sugar give at least temporary results and permit an increase in the weight of the patient.

SIGNORELLI, New Orleans.

EXPERIMENTS ON ARTIFICIAL FEEDING WITH THE ADDITION OF ACID TO THE FOOD. A. BORRINO, Scritti medici dedicati a Carlo Comba, ediz., Riv. di clin. pediat., 1929, p. 95.

The addition of lemon juice to the artificial milk feedings of forty-two infants under 6 months of age gave universally good results. There was a regular gain in weight, normal development and diminution of the soaps in the stools.

The author concludes: "Clinical observation gives evidence of a better absorption of fat and minerals. Aside from the action of the vitamins in the lemon juice, the effect of the acid on the gastro-intestinal digestion of milk is noteworthy."

HIGGINS, Boston.

ACIDOSIS IN EARLY INFANCY. SALVADOR E. BURGHI, Arch. de hosp. de niños, Roberto del Rio **1**:69 (June) 1930.

Acidosis is observed almost exclusively in artificially fed infants or in those given mixed feeding. Acidosis occurs readily in the infant in states of dystrophy. All cases presenting acute and severe dehydration show acidosis. In cases of chronic dehydration acidosis will develop when acute exacerbations of the dehydration occur.

Clinical symptoms of acidosis are always present and pronounced in acute states of dehydration, but may not be apparent in chronic states of dehydration except in the terminal stages. In the cases with chronic dystrophy with or without acidosis, parenteral infections are almost always present. The most common form is purulent otitis media. In the majority of cases it is responsible for the dehydration.

Rickets does not play an important rôle as a causative factor in the production of this acidosis.

SCHLUTZ, Chicago.

THE USE OF BUTTERMILK IN THE FEEDING AND TREATMENT OF INFANTS WITH GASTRO-INTESTINAL DISORDERS. L. MORQUIO, Arch. de pediat. d. Uruguay **1**:409 (Aug.) 1930.

The author reviews his experience of twenty years with buttermilk feeding and compares his view expressed over twenty years ago with the one he now holds with regard to its usefulness in infant feeding.

The enthusiasm of this eminent clinician for buttermilk has cooled. He is using it less and less and only in exceptional cases. Among the reasons that have led him to this opinion he mentions: (1) the uncertain quality of the product, (2) the fact that infants under 5 months of age often take it poorly, (3) that its use is limited practically to cases observed in the hospital and (4) that it does not seem to be in any way superior to the milk of other animals or to simple dilutions of milk.

The author favors the use of simple dilutions of milk, but points out the fact that no single milk preparation has as yet appeared which is a panacea for all types of feeding and alimentary disorders and that breast milk feeding is superior to every form of artificial feeding.

SCHLUTZ, Chicago.

INFLUENCE OF MORBID PROCESSES IN INFANCY ON THE DEVELOPMENT OF THE DENTAL ARCH. JUAN BELTRÁN CUBINA, Med. de los niños **31**:40 (Feb.) 1930.

Peculiarities of the dental arch may originate in the embryo. Abnormal insertion of the labial frenum produces separation of the inferior central incisors. Certain habits, such as sucking the thumb or biting the tongue or lips, cause a change in the direction of the teeth, for example, protrusion of the upper incisors. Disturbances in the glands of internal secretion, especially the thyroid and pituitary glands, and disease of the nasal and postnasal passages affect the facies and consequently the dental arch. Other factors, such as the exanthems with elevation of temperature, breathing through the mouth, due to enlarged tonsils and adenoids, and persistent catarrh bring about malocclusion, which in turn affects the health deleteriously.

DWYER, Kansas City, Mo.

A CASE OF INFANTILE SCURVY. FRANCISCO J. PRAT PARDAS, Med. de los niños **31**:83 (March) 1930.

A severe case of scurvy in a child aged 23 months is described. The patient presented swelling of the joints, limitation of motion with intense pain and, after several months, fever. The condition was variously diagnosed as coxalgia, arthritis, polyneuritis and scurvy. Three tablespoonfuls of orange juice and a change to fresh milk resulted in the disappearance of bleeding of the gums in three days. The child was entirely well in about three months. The relation of vitamins A, B, C and D to the health of the infant is discussed.

DWYER, Kansas City, Mo.

THE VITAMIN C CONTENT OF SWEETENED CONDENSED MILK. A. BAHKE, Arch. f. Kinderh. **90**:188 (May 24) 1930.

In experiments on guinea-pigs, the author was unable to find that the vitamin C content of condensed milk was appreciably diminished.

SANFORD, Chicago.

EGG SOUP AS FOOD FOR INFANTS. W. STOELTZNER, Deutsche med. Wchnschr. **56**:4 (Jan. 3) 1930.

The new-born chicken can walk and eat mixed food, and is ready for unassisted, independent life. The new-born calf also can walk, but still has to be nourished by the milk of its mother. The new-born infant needs its mother even more, and without her assistance it would die. In development, therefore, the new-born calf corresponds to an infant that has just been weaned, and the new-born chicken corresponds to a child 3 or 4 years of age. On the basis of this parallelism the author assumes that breast milk contains the food requirements of the earliest postnatal age, whereas the cow's milk is adapted to the weaning age of the infant. On the other hand, the egg contains all the constituents of a full term chicken, which is equal in maturity to a child aged 3 or 4 years. The egg is therefore adapted to any age between late prenatal life and early childhood. Stoeltzner advises the use of egg for: (1) premature infants, (2) infants that are full term, but weakly developed and (3) normal children who thrive poorly on breast milk. These children are not sufficiently developed for either breast or cow's milk, but they are ready for egg soup. They are given a mixture which contains 2 per cent protein, 2.5 per cent fat and 9 per cent carbohydrate. The

caloric value of the egg soup is equal to the caloric value of whole milk. Children fed egg soup do not have rickets or anemia, and give a satisfactory weight curve. Hydrolabile children become stable in their weight perhaps because of the antirachitic vitamin contained in the egg yolk.

KERESZTURI, New York.

THE DOSAGE OF IRRADIATED ERGOSTEROL. S. WOLFF, Deutsche med. Wchnschr. **56**:12 (Jan. 3) 1930.

For a child, aged 4 weeks, 9 drops of irradiated ergosterol was prescribed three times a day. At the age of 6 months, the child became pale, lacked appetite and appeared restless. Examination showed poor turgor and tonus, no fever, a chronically sick appearance, closed fontanels, no teeth, pallor, an enlarged heart, tachycardia amounting to 200 beats per minute, a poor pulse and a hemoglobin content of 70 per cent. The case was diagnosed as ergosterol poisoning, and the drug was omitted. In four weeks the tachycardia disappeared, and the child gradually recovered. Although irradiated ergosterol is distributed in greater dilutions now than in the past, individual tolerance to it varies so much that great care should be exercised in prescribing it.

KERESZTURI, New York.

BUTTERMILK IN INFANT FEEDING. S. ENGEL, Deutsche med. Wchnschr. **56**:433 (March 14) 1930.

Powdered buttermilk was used for six months in the pediatric department of the city hospitals in Dortmund, Germany. It is as effective as liquid buttermilk, and is easy to dilute and handle. It also has the advantage of being stable in acidity and fat content.

KERESZTURI, New York.

BONY CHANGES AFTER TREATMENT WITH PHOSPHORUS AND COD LIVER OIL. M. BRANDES, Deutsche med. Wchnschr. **56**:655 (April 18) 1930.

Birk published an article describing strong calcification on the border of the bone and cartilage of the ribs of children given the Gerson-Hermannsdorfer diet. He attributed these changes chiefly to the vitamin content of the cod liver oil. Brandes does not agree with him, but collects evidence from the medical literature to prove that phosphorus has an important rôle in this calcification.

KERESZTURI, New York.

THE CHOLESTEROL CONTENT OF THE LARGE INTESTINE IN MAN. M. BÜRGER and H. D. OETER, Ztschr. f. physiol. Chem. **184**:257, 1929.

The mucosa of the large intestine contains free sterol, but no observable amounts of esterified sterol. The average cholesterol content of the whole mucosa from a large intestine is 0.78 Gm. The cholesterol content of the mucosa alone is about three times that of the large intestine as a whole. These figures show that mere sloughing off of the intestinal mucosa could not account for the sterol content of the feces, and they support the view that the large intesine in the human being acts as an excretory organ for sterols.

KUGELMASS, New York.

VITAMIN A IN THE POPULATION OF AMSTERDAM. L. K. WOLFF, Arch. néerl. de physiol. **14**:282, 1929.

The vitamin A content of the liver was estimated by taking 5 Gm. of liver, mixing it with 45 Gm. of anhydrous sodium sulphate and extracting with chloroform in a Soxhlet apparatus and concentrating the extract to 10 cc. The antimony trichloride color test was carried out on this extract, using the Lovibond tintometer. The color produced by 10 mg. of a good cod liver oil under standard conditions was taken as a unit. No vitamin A was found in the bodies of two rats after

removal of the liver, and no loss occurred in a rabbit up to three days post mortem. The livers of one third of over 200 subjects, who died of acute or chronic disease or of accidents, contained from 10 to 30 units per gram, as did the livers of the cattle examined; in 10 per cent the amount was negligible, and in 25 per cent only 1 to 10 units per gram were found. The livers of new-born infants contained little or no vitamin A. There was also no relation between the fatness of a subject and the vitamin A content of the liver. It is considered that these figures are representative of the vitamin A stores in the livers of the people of Amsterdam, since the distribution was the same in those killed accidentally as in those who died of disease.

KUGELMASS, New York.

THE PREPARATION OF VITAMIN D WITH THE AID OF ULTRAVIOLET LIGHT. E. H. REERINK and A. VAN WIJK, Nederl. maandschr. v. geneesk. **17**:1, 1930.

The authors, scientific collaborators in the laboratories of Philips Glowlamp Works, Eindhoven, Holland, give a survey of their work on the preparation of a pure, isolated vitamin D without any of the useless by-products that may be produced when ergosterol is treated with ultraviolet rays. The amount of vitamin in the irradiated pure ergosterol is measured quantitatively by the spectrophotometric method, of which the authors give a detailed description (this is considered the most exact method). The results were controlled by experiments in vivo in rats and by the effect on rachitic children.

The authors found that vitamin D is the primary product formed from ergosterol by irradiation with ultraviolet light of a wavelength between 300 and 280 microns. They succeeded in obtaining vitamin D in a pure state by carefully removing the remaining ergosterol from an ergosterol solution reduced to less than 50 per cent by the aforementioned wavelength. In this way they obtained a substance that showed a definite absorption-spectrum and that crystalized from ether at a very low temperature. The melting point of the crystals was probably lower than —20 C. At room temperature vitamin D is a colorless oil-like substance, oxidizing rapidly when exposed to the air. One may prevent this oxidation, which makes the vitamin inactive, by dissolving it in oil or in fat.

The product proved to be highly active against rickets; in rachitic children a complete cure was obtained within 14 days with a daily dose of 0.04 mg. of a product that contained about 30 per cent of vitamin D. This amount is about 100 times smaller than the amount usually given. As it is not impossible that the described toxic effects of large amounts of vitamin D are caused by products formed by defective irradiation of ergosterol, the use of a pure vitamin D product may also be of great value.

VAN CREVELD, Amsterdam, Holland.

Diseases of the New-Born

AN ANATOMICAL STUDY OF SUBDURAL HEMORRHAGE ASSOCIATED WITH TENTORIAL SPLITTING IN THE NEWBORN. W. H. CHASE, Surg. Gynec. Obst. **51**:31, 1930.

This communication contributes an etiologic and anatomic analysis of a series of thirty-two cases of subdural hemorrhage associated with tentorial splitting in the new-born infant. The hemorrhage is largely supratentorial and often bilateral as a result of stretching or rupturing of the small tributaries of the great cerebral vein near its junction with the straight sinus. The most important predisposing factor in intracranial hemorrhage and tentorial splitting is prematurity, in that the dural septal fibers are of greater immaturity. The method of examination, anatomy and clinical aspects are adequately discussed.

LIFVENDAHL, Chicago.

HAEMOGLOBINURIA IN THE NEWBORN. JEAN SMITH, Arch. Dis. Childhood **5**: 275 (Aug.) 1930.

A case of hemoglobinuria in a girl, aged 1 month, is reported. There was a purple discoloration of the body and methemoglobin was found in the urine. The blood was brown. Spectroscopic examination of the serum revealed the presence of oxyhemoglobin bands only. The indirect van den Bergh test was slightly positive and the fragility of the red cells slightly increased. The liver and spleen showed large quantities of hemosiderin. The convoluted tubules of the kidneys contained a considerable quantity of hemosiderin.

The author brings out the factor of infection in the etiology. Any pathogenic organism that is sufficiently virulent can cause hemoglobinuria in the new-born infant.

KELLY, Milwaukee.

MULTIPLE LOCALIZED CALCAREOUS CONCRETIONS IN THE SKIN WITH LOCALIZED SCLERODERMA IN MOTHER AND CHILD. P. LEREBOULLET and M. LELONG, Bull. Soc. de pédiat. de Paris **28**:53 (Feb.) 1930.

A girl, aged 7 years, was first seen because of obesity which had made its appearance when she was 4 years old. She had thick hands with short stubby fingers and may have had some thyroid insufficiency. She was found to have multiple indurated masses of stony hardness under the skin: two on the outer aspect of the left leg, a large area over the anterior lower right half of the abdomen, one in the right suboccipital region and two stony areas on the internal surface of the left foot. The frontal bone was somewhat keel shaped, having a median ridge and lateral depressions. There was a large pigmented nevus over one trochanter. She had a bilateral Chvostek sign. The blood calcium was normal. The mother presented a pencil-shaped stony mass in the subcutaneous tissue of the left forearm. All of the masses, both in the child and in the mother, cast dense shadows in the roentgenograms.

BENJAMIN, Montreal, Canada.

THE PROPHYLAXIS OF DIPHTHERIA IN THE NEW-BORN. P. LEREBOULLET, Paris méd. **1**:527 (June 7) 1930.

In the Sick Infants' Hospital, Paris, thirty-eight cases of diphtheria were seen in a year. For this reason the following technic was adopted: (1) cultures in all cases, with repeated cultures in those of coryza; (2) isolation of all suspicious cases and carriers, and (3) disinfection of the nasal fossae with acriflavine hydrochloride and arsenicals (neoarsphenamine). A 0.15 Gm. ampule of neoarsphenamine is dissolved in 2 cc. of water, and 2 or 3 drops are placed in each nostril several times a day.

Before this treatment was carried out, the mortality was 56 per cent among carriers. Only 2 deaths were due to diphtheria, the remainder being due to gastro-intestinal disturbances and bronchopneumonia. Under this form of treatment, 101 carriers were treated, with a mortality of 7 per cent.

SANFORD, Chicago.

A RARE CAUSE OF UNCONTROLLABLE VOMITING IN THE NEW-BORN (CONGENITAL ATRESIA OF THE STOMACH). GIOVANNI ANDREA PIANA, Clin. pediat. **12**:431 (May) 1930.

The author describes a case of congenital atresia of the stomach in a newborn infant delivered at term. All fluids, even in the smallest quantities, were promptly vomited and no treatment was of avail. There was obstinate constipation and rapid loss of weight.

Autopsy, held on the sixth day after birth, revealed the stomach to have a capacity of only 4 cc. Its walls were rigid, the mucosa atrophied and the submucuous tissues normal. The muscular development of the organ was deficient

in comparison with that of a normal new-born infant, but excessive in proportion to the size of the organ and of its other tissues.

SIGNORELLI, New Orleans.

THE PATHOGENESIS OF ICTERUS NEONATORUM. G. PEDRINONI, Riv. di clin. pediat. **28**:758 (Sept.) 1930.

The author studied the hepatic function in children with icterus neonatorum to obtain evidence as to cause of the condition. The jaundice is more evident in infants born after a difficult labor, in premature infants, in infants that have lost considerable fluid and in infants in whom the umbilical cord was tied late. These facts point to hemolytic jaundice. On the other hand, the results of the indirect van den Bergh test, the slight increase in granular red cells and the lack of other indications of hemolytic jaundice suggest that the jaundice is obstructive.

Pedrinoni's opinion is (1) that the jaundice is not physiologic but pathologic and (2) that it is probably hemolytic.

HIGGINS, Boston.

INTRACRANIAL HEMORRHAGE IN THE NEW-BORN. L. SANTOS, Ann. do quinto Cong. brasileiro de Hyg. **2**:525 (Oct. 17) 1929.

The author performed autopsies on 1,387 new-born infants who died shortly after birth. In twenty-two per cent of instances death was due to intracranial hemorrhage.

SANFORD, Chicago.

THE CAUSES OF XANTHOCHROMIA IN THE SPINAL FLUID OF THE NEW-BORN. JUAN P. GARRAHAN and CARLOS M. PINTOS, Arch. argent. de pediat. **1**:148 (May) 1930.

The authors believe that the appearance of xanthochromia in the spinal fluid of new-born infants has some connection with dysfunction of the physiologic bilirubin secretion. They are unable to say whether the yellow pigment seen in the fluid is due to bilirubin; it may be due to the related pigment. They are not convinced that hemorrhages due to birth trauma are a large factor in the production of xanthochromia. The problem needs further study.

SCHLUTZ, Chicago.

HEMOTHERAPY FOR SEPSIS IN THE FIRST WEEKS OF LIFE. G. N. SPERANSKI, Jahrb. f. Kinderh. **128**:95 (June) 1930.

The injection of blood from the mother into the gluteus muscle of fifty infants with sepsis resulted in recovery in thirty-six cases.

CLAUSEN, Rochester, N. Y.

Acute Infections

DIPHTHERITIC MASTOIDITIS WITH BRADYCARDIA SIMULATING INTRACRANIAL DISEASE. NOAH FOX, Arch. Otolaryng. **11**:780 (June) 1930.

A boy, aged 17 years, gave a history of having had an infection of the upper respiratory tract ten years before, followed by a chronic discharge from the ear. After five days of acute illness with chills and fever a fluctuant swelling developed behind the left ear with foul-smelling discharge from the ear canal. A mastoidectomy was performed which showed extensive destruction of the tissues. On the third day postoperatively he became much worse, with vomiting and slow pulse. Intracranial disease was suspected. The wound showed a membrane which suggested diphtheria, and smears and cultures proved that *Bacillus diphtheriae* was present. Two injections of 20,000 units each of diphtheria antitoxin were given forty-eight hours apart. Recovery was normal except that a partial heart block developed from the diphtheria infection.

The author suggests the advisability of more frequent culture on Klebs-Löffler mediums as a method of earlier diagnosis of diphtheritic infection in mastoiditis.

BARNETT, Chicago.

MEDICAL ACCOUNTING IN COMMUNICABLE DISEASES. HENRY J. SPENCER, New York State J. Med. **30**:699 (June 15) 1930.

The reduction in mortality at the Willard Parker Hospital has been brought about not alone by medical aseptic technic and cubicles but also by better monthly statistics. Such extensive reports show the true results at all times and permit the early correction of errors in technic. (Numerous charts are shown.)

In all chronic cases of intubation, the patient has been discharged to his home. There has been a great reduction in tracheotomies and intubations. Direct laryngoscopy and suction by the Sorenson pump are now used.

AIKMAN, Rochester, N. Y.

SUMMARY OF CURRENT PREVALENCE OF COMMUNICABLE DISEASES. Pub. Health Rep. **45**:2609 (Oct. 24) 1930.

For the period of Sept. 7 to Oct. 4, 1930, the incidence of poliomyelitis has increased to 1,837 cases, as compared with 358 one year ago. Meningococcus meningitis, diphtheria, influenza, measles, scarlet fever, smallpox and typhoid fever show a lower incidence than last year. The mean mortality is 10.2, as compared with 10.7 last year.

SANFORD, Chicago.

THE THERAPEUTIC VALUE OF STREPTOCOCCUS ANTITOXIC SERUM IN SCARLET FEVER. T. TOYODA, J. MORIWAKI, Y. FUTAGI and S. HOSHIZAKI, Brit. J. Child. Dis. **27**:181 (July-Sept.) 1930.

The criteria used in estimating the therapeutic results of injections of serum were: improvement in the general condition, especially the toxic symptoms; comparatively rapid fading of the rash; a fall in temperature; reduction of the rate, and improvement in the quality, of the pulse; increase in the amount of urine, and the presence or absence of complications.

The concentrated antistreptococcic and antitoxic serum prepared in the United States (by Eli Lilly and Company and Parke, Davis and Company) was found more effective than the nonconcentrated serum prepared in the Government Isolation Hospital at Dairen, Manchuria. It was used only in the severe cases and reduced the death rate by half. The serum seemed to have some effect in reducing the incidence of complications.

LANGMANN, New York.

AN EPIDEMIOLOGICAL STUDY OF DIPHTHERIA IN A REMOTE NEW ZEALAND COMMUNITY. C. E. HERCUS, R. A. SHORE, H. E. BARRETT and J. H. NORTH, J. Hyg. **29**:243, 1929.

Epidemiologic and immunologic studies of two outbreaks of diphtheria in a remote and unsalted country district in New Zealand are presented. The first epidemic occurred in August and was thought to be air borne. This was followed in the succeeding spring by the second epidemic, which was probable milk borne.

"The practical lessons which may be learnt from this study are: (a) That unless a special buffered diluent is used, the toxin used for Schick testing must be freshly diluted near the place where it is to be used. (b) Active immunization of remote unsalted communities against diphtheria requires more time, and more intensive courses of prophylactic, than areas where diphtheria has been endemic for some years. (c) In such places with a low original herd immunity, it is essential, even more than in endemic centers, never to omit retesting those who

have been inoculated, in order to be certain that any attempt made to induce active immunity to diphtheria may be successful. (d) Estimations of the relative efficiency of diphtheria prophylactics, which are based on the rapidity with which samples of children become immune, are worthless unless all the observations have been made in the same environment on groups having the same original herd immunity. (e) An immunity, good enough to withstand droplet infection in a day school environment may be broken down by massive doses of diphtheria bacilli in milk."

J. N. PATTERSON.

VACCINIA OF THE TONGUE. M. VIEU, Ann. de dermat. et syph. 1:873 (Aug.) 1930.

Vieu reports the case of a young child in whom several vaccine lesions developed on the face and tongue following the ordinary procedure of vaccination. There were five umbilicated pustules scattered on the tongue. This is the fourteenth case that has been reported. Besides being pustular, the lesions may be papular. The diagnosis is not difficult if the possibility of such a condition is kept in mind.

MICHAEL, Houston, Texas.

SCARLET FEVER AND ENDOCARDITIS WITH PERSISTENT MURMUR FROM MITRAL INSUFFICIENCY. G. L. HALLEZ, Bull. Soc. de pédiat. de Paris **27**:367 (July) 1929.

The author reports two cases of scarlet fever with arthritic manifestations in which endocarditis, with mitral insufficiency developed. He discusses the question of whether or not the arthralgia in scarlet fever is related to that in acute rheumatic fever. He concludes that although somewhat analogous, rheumatic endocarditis and scarlatinal endocarditis are not of the same nature.

BENJAMIN, Montreal, Canada.

PURULENT ARTHRITIS DISCLOSING AN ACUTE ARTICULAR RHEUMATISM OF INFECTIOUS TYPE WITH CARDIAC INVOLVEMENT. E. LESNÉ, GILBERT-DREYFUS and T. BROSSE, Bull. Soc. de pédiat. de Paris **27**:395 (July) 1929.

A boy, aged 8 years, complained of sore throat, headache and abdominal pain for three days. His temperature was from 38 to 39 C. (100.4 to 102.2 F.). Physical examination gave essentially negative results; a reddened throat and a slightly coated tongue were noted. A culture of the blood was negative for typhoid bacilli. Roentgenologic films of the chest showed no abnormality. On the eighth day he had pain in the lower right part of the chest. Nothing definite was found. Because pneumococci in pure culture were grown from the throat, it was thought that a pneumococcic bacteremia might be present. Suddenly on the eleventh day the left knee became painful, red, hot and swollen. Purulent fluid was withdrawn which contained a few lymphocytes but chiefly disintegrated polymorphonuclear leukocytes. Smear and culture of the fluid showed no organisms. On the fourteenth day the left knee was better, but the right knee became inflamed; for the first time, the first cardiac sound was muffled. The next day the patient was given 6 Gm. of sodium salicylate, which was continued as a daily amount for some time. On the following day the temperature dropped to normal for the first time, and thereafter did not rise more than a fraction of a degree above normal. The cardiac damage, however, continued and the patient had a definite mitral lesion when he was discharged from the hospital about a month later. The authors consider that they were dealing with an infectious form of acute articular rheumatism which at first showed only the signs of a toxemia, the arthralgias appearing later in the picture and disappearing on the administration of salicylates, which revealed their true rheumatic nature. This form of the disease is much rarer in children than in adults.

BENJAMIN, Montreal, Canada.

DIPHTHERIA OBSERVED IN MARSEILLES AFTER ANTIDIPHTHERITIC IMMUNIZATION. M. PHILIP, Bull. Soc. de pédiat. de Paris **27**:536 (Dec.) 1929.

In a survey made a maximum of 3 per cent of children who were given three doses of anatoxin had diphtheria not sooner than twenty days after the last injection. All of these presented moderate cases of the disease with the exception of one case of laryngeal diphtheria. The fact that a great majority of the children were permanently protected by active immunization confirms the belief in its well established benefits. Parents are exhorted to have their children immunized.

BENJAMIN, Montreal, Canada.

FIXATION ABSCESS IN DIPHTHERIA. J. COMBY, Bull. Soc. de pédiat. de Paris **28**:49 (Feb.) 1930.

Comby inveighs against the use of the fixation abscess, first described by Fochier, in the treatment of children with diphtheria. He also stresses the fact that it is of no value in many diseases in which it has been tried.

BENJAMIN, Montreal, Canada.

HIRSUTISM FOLLOWING MUMPS: ROENTGEN THERAPY OVER THE SUPRARENAL REGIONS; DIMINUTION OF HYPERTRICHOSIS. E. LESNÉ, G. DREYFUS-SÉE and J. A. LIEVRE, Bull. Soc. de pédiat. de Paris **28**:94 (March) 1930.

A girl, aged 10 years, had shown marked obesity accompanied by hypertrichosis for three years. The condition began to appear during the first month after an attack of mumps; she gained 800 Gm. during that month despite the fact that she had always been underweight. In the course of a few more months a downy covering developed on the skin and hypertrichosis was seen over the back, upper lip, limbs, etc.; this condition as well as the obesity became progressively worse. The syndrome resembled that seen in a child with a malignant tumor of the cortical suprarenal gland (hypernephroma). The good general condition of the patient, however, and the long duration of the clinical signs, as well as the absence of any tumor in the lumbar region, were rather in favor of the presence of a hyperplasia of the cortical cells of the suprarenal gland. Roentgen therapy over the suprarenal regions was followed by improvement in the hypertrichosis, but there was no change in the obesity.

BENJAMIN, Montreal, Canada.

MULTIPLE LARGE PLAQUES OF CUTANEOUS GANGRENE IN THE COURSE OF VARICELLA. APERT and GOLDBERG, Bull. Soc. de pédiat. de Paris **28**:106 (March) 1930.

A boy, aged 5 years, was admitted to the hospital with areas of dry gangrene of the skin over both knees, over the right loin and over the lateral aspect of each buttock. These gangrenous patches of skin began to develop about ten days after the eruption of varicella lesions. The patient's general condition was good. He had no fever. The areas of gangrene showed no particular relationship to the scars of the varicella lesions, so that the condition was not one of gangrenous chickenpox. He also showed a few small ecchymotic stains and some rare petechiae, and he had one nosebleed at the onset of the condition. The blood coagulation and bleeding rates were normal. The lesions healed with the formation of cicatrices. The patient most likely had gangrenous purpura during his convalescence from varicella.

BENJAMIN, Montreal, Canada.

REPORT OF THE COMMISSION ON ANTIDIPHTHERITIC IMMUNIZATION. E. TERRIEN, Bull. Soc. de pédiat. de Paris **28**:142 (March) 1930.

Because several physicians had reported cases of diphtheria in children who had received injections of anatoxin to immunize them against the disease, a com-

mission was appointed to investigate the frequency and possible explanation of such cases. The report made after a survey of the situation in Paris emphasizes the importance of generalizing the procedure for all young children. About 1 case of diphtheria occurred in every 1,600 immunized children, and the percentage of positive Schick reactions in immunized children was between 1 and 2 per cent. When definite diphtheria occurs in a previously immunized child, the child should be given antitoxic serum without delay, and the case should be reported to the Pasteur Institute, from which it will be thoroughly investigated in order to ascertain if the immunization was incompletely or irregularly carried out or if the child did not become totally immune after the usual properly administered injections.

BENJAMIN, Montreal, Canada.

PNEUMOCOCCUS SEPTICEMIA TWO MONTHS AFTER PNEUMONIA. L. BOIDIN, BERTRAND-FONTAINE and FAYOT, Presse méd. **38**:983 (July 19) 1930.

A case of pneumonia is reported in a young woman who was apparently cured and two months later began to have fever and show purpuric spots, vegetating endocarditis and nonsuppurating parotitis. Cultures of the blood were positive for pneumococcus.

BIEKER, St. Petersburg, Fla.

A CASE OF POSTRUBEOLIC BILATERAL EXTERNAL NUCLEAR OPHTHALMOPLEGIA. PAUL PESME, BOISSERIE-LACROIX and R. PHILIP, Rev. d'oto-neuro-opht. **8**:187 (March) 1930.

Nervous complications following measles are rare and neuro-ocular sequelae still rarer. Only one case has been reported. A child, aged 8 years, had measles on June 26, 1929, during an epidemic in the school. She was considered well in sixteen days and returned to school, but complained of fatigue and a heaviness in the eyelids. In a few days there was complete ptosis. Examination showed a great deal of depression; the temperature was slightly elevated and the pulse rate was over 100 and regular. There was bilateral ptosis, and the eyes were immobile; the pupillary reactions and the eyegrounds were normal. The legs could be raised, but the movement was sudden. The gait was incoordinate, the feet wide apart, and in walking there were incoordinated movements of the trunk and arms. The tendon reflexes were equal but diminished; there was no Babinski's sign. There were choreo-athetoid movements of the arms. The pharynx showed no abnormality. The spinal fluid was normal, and the Bordet-Wassermann reaction was negative in both the spinal fluid and the blood. A diagnosis of encephalitis was made and intestinal lavage and injections of brand of sulpharsphenamine and methenamine, alternately, were instituted. After three weeks, improvement began and was complete in two months. An examination made three months after the patient had left the hospital showed complete restoration of the ocular movement. The choreo-athetoid movements were still present, but otherwise there was complete cure.

In the presence of these facts, the diagnosis of subacute poliencephalitis was made. The ophthalmoplegia came on late in the convalescence from measles, after the period when encephalitic complications usually occur; to be noted also is the fact that the attack of measles was mild. This appears to be an example of the direct action of the measles virus on the nervous system. Other virulent infections, such as variola, epidemic encephalitis, poliomyelitis and syphilis, have an affinity for the cutaneous covering and the nervous structure, both derived from the ectoderm. Levaditi has studied some of these infections experimentally and grouped those having common characteristics under the name of neurotropic ectodermoses. This observation shows that neuro-ocular complications of rubeola have a spontaneous tendency to complete recovery.

DENNIS, Colorado Springs, Colo.

PROPHYLAXIS FOR DIPHTHERIA WITH ANATOXIN. R. TAVARES, Ann. do quinto Cong. Brasileiro de hyg. 2:205 (Oct. 17) 1929.

As prophylaxis for diphtheria, the author uses three doses of anatoxin: first, 0.5 cc.; three weeks later, 1 cc., and two weeks later, 1.5 cc. Schick tests showed immunity of 60 per cent after one dose, of 80 per cent after two doses and of 100 per cent after three doses.

SANFORD, Chicago.

PNEUMOCOCCEMIA WITH RARE CUTANEOUS MANIFESTATIONS. MIGUEL A. JAUREGUY, Arch. de pediat. d. Uruguay 1:480 (Sept.) 1930.

In a colored child, aged 13 years, an infectious process developed in three stages. During the first stage, lasting one day, there were intense constitutional symptoms resembling those of grip. During the second stage the child presented grave toxic symptoms, rash and vesicular lesions on the skin and intense purulent conjunctivitis. The third stage was much delayed, and complete recovery occurred.

The condition occurred during the winter months and while an extensive epidemic of measles was prevalent. A diagnosis of pneumococcemia was made. Clinically it appeared to be an atypical form of measles, but there was no history of exposure or contact. The atypical form of measles usually occurs in pneumococcemia and is apt to occur in the colored race.

SCHLUTZ, Chicago.

PNEUMOCOCCAL SEPTICEMIAS IN INFANCY. A. CASTELLANOS, Bol. Soc. cubana de pediat. 2:331 (Aug.) 1930.

The pneumococcic septicemias of childhood differ decidedly from those observed in the adult. In the child they are generally due to type II pneumococcus, whereas in the adult they are more commonly due to the type IV organism.

New-born and premature infants are extraordinarily susceptible to the infection and often have subacute forms with little localization. The infection is particularly severe and hypertoxic in colored children. It is characterized by a myeloleukocitic reaction of the blood with a tendency to a leukemic picture.

The general health of the child is markedly affected, with great loss of weight and extreme emaciation. Meningeal complications, endocarditis and peritonitis are common. The kidney, liver and joints are seldom involved.

SCHLUTZ, Chicago.

ATYPICAL GERMAN MEASLES. L. O. FINKELSTEIN and R. W. STOJANOWSKAJA, Arch. f. Kinderh. 90:181 (May 24) 1930.

The authors observed twenty-eight cases in a sanatorium in four months. Nearly all cases occurred in children from 5 to 8 years of age. There were no prodromal symptoms, an exanthem being the only manifestation. The temperature was never elevated, and none of the children complained of symptoms. The eruption consisted of localized patches which appeared first on the cheeks and then on the entire body. It did not involve the nose and lips, and in this way resembled scarlet fever. The lesions spread rapidly, and the picture was complete in twenty-four hours. The lesions were from 3 to 5 mm. in diameter, with irregular margins. They never became confluent. In many cases, there were light red patches from 2 to 3 mm. in diameter on the inside of the cheeks and on the hard and soft palate. The exanthem disappeared in twenty-four hours, leaving a brownish pigmentation that lasted for several days. There was no desquamation or enlarged lymph nodes. At first the authors thought that this might be an undescribed "seventh disease," but later they decided that it was a rare form of German measles.

SANFORD, Chicago.

DIPHTHERIA EPIDEMIC IN A CAMP SANATORIUM. W. SILBERSCHMIDT, Deutsche med. Wchnschr. **56**:387 (March 7) 1930.

The Institute of Hygiene in Zurich made the observation that the diphtheria morbidity among adults has a tendency to increase. Women were chiefly affected in an epidemic lasting two months. The first and last cases were widely separated, but most of the twenty-two cases observed occurred within three or four days. Among the patients, five were children and seventeen were adults. Only two of the twenty-two patients were males, but the majority of the guests at the summer resort where the epidemic occurred were women. Besides the twenty-two patients, in all of whom diphtheria was verified clinically and bacteriologically, five diphtheria bacillus carriers were discovered. One of them was a milker, who probably was responsible for the rapid and extensive spreading of the contagion. The procedure for stopping the spread of the contagion was: (1) isolation of the patients, (2) a bacteriologic examination of all persons, (3) notification of the guests about the disease and encouragement of cleanliness, (4) limitation of communication and (5) disinfection of the room where a patient lived. The contagion remained localized in one boarding house and no one in the neighboring hotels became sick.

KERESZTURI, New York.

THE THEORETICAL BASIS AND RESULTS OF IMMUNIZATION AGAINST DIPHTHERIA. F. FRIEDBERGER, Deutsche med. Wchnschr. **56**:389 (March 7) 1930.

According to Friedberger, the theoretical basis of active immunization against diphtheria is not yet proved convincingly. After immunization the reaction to the Schick test often becomes negative, though this does not mean necessarily that the children giving negative reactions are immune. The serious cases of diphtheria among the immunized and nonimmunized group seems to prove that immunization against diphtheria is of doubtful value. As a rule, the immunization does not produce acute symptoms. However, the diphtheria toxin in the body may become free at any time and cause trouble. In June, 1929, the League of Nations was optimistic about immunization against diphtheria. In September, 1929, however, they had to make the statement that the European results were not as promising as the American ones.

KERESZTURI, New York.

THE PRIMARY FOCUS AND AREA OF INVASION IN SPECIFIC INFECTIOUS RHEUMATISM. S. GRÄFF, Deutsche med. Wchnschr. **56**:603 (April 11) 1930.

The author tries to establish the clinical entity of specific infectious rheumatism on the grounds of pathologico-anatomic examinations, and assumes that various rheumatic clinical pictures are caused by one agent. A clinical condition can be identified as specific infectious rheumatism, by typical tissue reactions, as, for instance, Aschoff bodies in the myocardium or nodules in the tissue of tendons, with the same accuracy as tuberculosis can be diagnosed by the pathologist. In analogy with other chronic infectious diseases, the author believes that it is possible to demonstrate the primary focus and complex, the focus of secondary infection and finally the dissemination of the infecting agent in the blood stream. He reports three cases illustrated by photomicrographs.

KERESZTURI, New York.

LYMPHATIC REACTION OF GLANDULAR FEVER. W. STEPP and H. WENDT, Deutsche med. Wchnschr. **56**:645 (April 18) 1930.

In 1889, Pfeiffer described a symptom-complex called lymph gland fever. It consists of fever, generalized enlargement of the lymph glands, and hypertrophy of the liver and spleen. In 1907, Türk added one more symptom to the conception of glandular fever—lymphocytosis. Later, similar or identical conditions

were designated as agranulocytosis, infectious mononucleosis, monocytic angina or lymphatic reaction.

The authors describe three cases and draw the following conclusions: 1. The lymphatic reaction is the main symptom and often precedes the angina. 2. Next in importance is the generalized enlargement of the lymph nodes. 3. Fever is an important symptom. 4. The definitely acute onset and the relatively good general condition are diagnostic signs differentiating the disease from acute lymphatic leukemia. 5. The lymphatic reaction in glandular fever usually lasts longer than the fever itself, which persists for many weeks and disappears gradually. 6. The prognosis is good. 7. Indications from a few recent epidemics are that the cause of the disease is an unknown lymphotrophic virus. The lymphatic reaction is probably primary, and the angina only a complication.

KERESZTURI, New York.

ALASTRIM, SMALLPOX AND SMALLPOX VACCINATION. E. LESCHKE, München. med. Wchnschr. **76**:2079 (Dec. 13) 1929.

Leschke has made an extensive study of the relation between alastrim and smallpox. Cases of alastrim have been described on both American continents, and in Switzerland, England, Holland and the Azores. The author considers alastrim a mild form of smallpox which he terms variola mitigata. The virus of both diseases produces similar lesions in rabbits. Rabbits immunized against either disease are protected against experimental infection by both. The serum of rabbits immunized against either disease acts quantitatively alike against both viruses. Vaccination against smallpox protects against both diseases. The mortality in alastrim is low, about 1 per cent. To prevent epidemics of alastrim the same precautions as are taken against smallpox are necessary. The danger of encephalitis following vaccination may be diminished by the use of a less virulent vaccine, only one, or at the most two, incisions and vaccination as early as possible.

BRAHDY, Mount Vernon, N. Y.

THE OCCURRENCE OF A NEGATIVE PHASE FOLLOWING IMMUNIZATION AGAINST DIPHTHERIA. J. SIEGEL, München. med. Wchnschr. **77**:1054 (June 20) 1930.

Several cases have been reported in which diphtheria developed shortly after active immunization against this disease. These are not considered as coincidences, but rather as the result of a lowering of the resistance by the materials injected. This lowered resistance or negative phase may occur after the injection of toxin-antitoxin or anatoxin of Ramon. Siegl investigated the occurrence of a negative phase after the injection of toxoid. He was unable to use toxin-antitoxin because immunization by this method is forbidden in Austria. The serum of three infants, 4, 6 and 8 months of age, was tested for its content of antitoxin. Then each received 0.4 cc. of toxoid subcutaneously. On the four following days the antitoxin content of the serum was determined. In each case the antitoxin titer was reduced to one-half in twenty-four hours, and in one infant to one-fourth the original titer on the second, third and fourth days. One determination made eight days after the injection showed that the titer had returned to its original level. In other children there was no negative phase but a rapid rise in antitoxin following the injection of toxoid.

In view of his results the author urges certain precautions in immunizing against diphtheria. Immunization should be carried out at times when diphtheria is not prevalent and after bacteriologic examination of the nose and throat. Parents should be warned to watch for the early signs of diphtheria during the first week following immunization.

BRAHDY, Mount Vernon, N. Y.

SCARLET FEVER PROPHYLAXIS BY PASSIVE IMMUNIZATION. C. VÖLCKERS and

An epidemic of scarlet fever occurred in an institution caring for 223 children. Thirty-two cases developed in less than a month. Passive immunization with

10 cc. of serum (Behring) intramuscularly, repeated in 2 weeks and again in 1 week, was effective in checking the epidemic. Repeated injections were necessary because the protection afforded by the antitoxin does not persist longer than 2½ weeks. In conjunction with passive immunization, active immunization was carried out with Gabritschewsky toxin. Before active immunization, 87 per cent of the children gave positive Dick tests. Eight days after the third injection only 36 per cent of the reactions remained positive.

BRAHDY, Mount Vernon, N. Y.

THE DIAGNOSIS AND TREATMENT OF EPIDEMIC POLIOMYELITIS IN THE EARLY STAGES. FRITZ LANGE, München. med. Wchnschr. **77**:1395 (Aug. 15) 1930.

Lange describes the clinical picture in the preparalytic and early paralytic stages of poliomyelitis. The causative virus is probably the globoid body described by Flexner and Noguchi. The incubation period is usually from one to two weeks, but the extremes are two days and thirty-three days. In most cases the onset is characterized by nasopharyngitis or bronchitis. In some epidemics the onset is associated with malaise, anorexia and gastro-intestinal disturbances (diarrhea or constipation). The pulse is rapid in relation to the rise of 1 or 2 degrees in temperature. There may be circumorbital edema and generalized sweating. Soon the child becomes irritable and objects to any disturbance. The early signs of meningeal irritation, such as twitching of the muscles, hyperesthesia and rigidity of the spine (Draper's spinal sign), appear. The sensorium remains clear. With the onset of paralyses the fever usually recedes. The site of the lesion in the central nervous system, that is, whether spinal, bulbar or cerebral, varies in the different epidemics.

The abortive form occurs frequently. Nasopharyngitis or gastro-intestinal disturbances often develop in members of the family in close contact with a patient. American investigators have shown that nasal secretions from such contacts may contain the virus of poliomyelitis.

If the presence of meningeal irritation has been established by the signs enumerated, the type of meningitis can be established more closely by lumbar puncture.

BRAHDY, Mount Vernon, N. Y.

BENIGN MENINGITIS AS A COMPLICATION OF MUMPS. N. JOHANNSEN, München. med. Wchnschr. **77**:1403 (Aug. 15) 1930.

Johannsen calls the attention of the general practitioner to the not infrequent occurrence of meningitis as a complication of mumps. Wallgren has described mumps meningitis without mumps. The diagnosis was made on the course of the disease and the epidemiology. The meningitis usually begins a few days after the appearance of the parotid swelling. Lumbar puncture reveals fluid under slightly increased pressure containing an increased number of cells, which are mostly lymphocytes, and an increased amount of protein. Three mild cases and three severe cases are described in detail. All the patients made a complete recovery.

BRAHDY, Mount Vernon, N. Y.

THE USE OF THE SCHICK TEST IN INSTITUTIONS. OTTO KAAN, Wien. klin. Wchnschr. **43**:555 (May 1) 1930.

Otto Kaan summarizes his experience with the Schick test, which he employed as a routine measure in the Children's Asylum in Krems during an epidemic of diphtheria in the institution. Of fifty-eight boys who had been exposed and who were given the Schick test, seventeen showed a positive reaction and were given a prophylactic immunity. Two of the children giving negative Schick reactions had diphtheria. In another series four of thirty-four children giving negative Schick reactions came down with the disease. Kaan quotes other authors who have reported undoubted cases of diphtheria in children giving negative Schick

reactions. He notes that Professor Löwenstein praised the Schick test as a method of proving the value of any immunizing agent. Nevertheless, he states that Löwenstein has always emphasized that conclusive proof of the value of a method of active immunization can be tested only by the exposure and resistance of immunized persons to diphtheria. The author concludes that the Schick test cannot be wholly relied on in an institution where diphtheria has broken out, as there is always a small percentage of persons giving negative Schick reactions who contract the disease.

A. F. Abt, Chicago.

Magnesium Sulphate in Tetanus Neonatorum. Alois Bratusch-Marrain, Wien. klin. Wchnschr. **43**:810 (June 26) 1930.

Bratusch-Marrain confirms and adds to his experience in the use of magnesium sulphate in tetanus neonatorum. By increasing the dosage and the number of injections he reduced the mortality from 95 to 50 per cent. He concludes that the use of magnesium sulphate in conjunction with tetanus neonatorum can greatly reduce the mortality of the disease. It is necessary, however, to use higher dosages than have previously been reported, and it is also necessary to increase the number of daily injections. He is convinced that the magnesium sulphate is quickly eliminated and that it is necessary to inject it every three or four hours to obtain the most beneficial results.

A. F. Abt, Chicago.

Clinical Experimental Researches on Postvaccinal Encephalitis: Clinical Vaccination. A. Eckstein, Ztschr. f. Kinderh. **49**:218, 1930.

Eckstein vaccinated only children whose health was known to be good, after a long period of observation, using the skin under the right nipple, as has been the custom for years at the Düsseldorf clinic; he placed the emphasis of this research on postvaccinal encephalitis on the finding of the vaccine virus in the blood. He obtained positive results in eight cases, the majority on the sixth to eighth day after vaccination. One patient showed no fever. In one case two rises in temperature occurred on the fourth to eighth day, and again on the twelfth to thirteenth day, this time with a sort throat and a membrane on the tonsils. Cultures of the blood were positive on the sixth, eighth and fourteenth days, and a culture of the membrane on the fourteenth day. In only one case could a positive reaction be obtained in the spinal fluid. The author believes that encephalitis is independent of the fever and of the local reaction. The origin lies in the special condition, the virulence of the lymph, the massive infection, the special permeability of the blood and spinal fluid barrier, and the protection designated by Pirquet as the capacity for allergic reaction.

Emerson, Boston.

Clinical Experimental Researches on Vaccination Encephalitis: III. The White Blood Cells in Vaccination Against Smallpox. A. Eckstein, Ztschr. f. Kinderh. **49**:240, 1930.

To find the relation between white blood cells and vaccination, Eckstein studied 33 cases; twenty infants were vaccinated cutaneously and for the first time, three infants were vaccinated intracutaneously, as a control, and three adults were revaccinated cutaneously. He discovered nothing characteristic. The shift to the left in the majority of the cases, and the increase in plasma cells in 50 per cent of them, were not a specific result. In the three adults, there was no shift to the left or change in the total count, but there were a small relative lymphocytosis and some plasma cells.

Emerson, Boston.

Postvaccinal Encephalitis. E. Bienenstein, Ztschr. f. Kinderh. **49**:248, 1930.

According to the literature, the ratio of cases of encephalitis to the number of patients vaccinated is 1:100,000 in Germany, 1:48,000 in England and 1:4,000

in Holland. Bienenstein reports that there were 20 cases in Vienna among 39,000 vaccinations, and of these he observed 5. The disease began acutely from 11 to 13 days after inoculation, with a high temperature, drowsiness or coma and, with the exception of case 5, a stiff neck, Kernig's sign and photophobia. There was no paralysis of the ocular muscles. In 2 cases there was flaccid paralysis of the extremities; in all cases except case 5, disturbances of the bladder and rectum; in cases 4 and 5, spastic paralysis of the extremities, and in case 3, a somewhat diminished mobility of the arms and legs. Sensation was disturbed in all cases; in cases 1, 2 and 3 the sense of touch was intact, but pain and temperature sense was diminished or increased; in cases 1, 2 and 4, hyperesthesia was present, and in case 5, hypo-esthesia. Trophic disturbances were astonishing in cases 1 and 2, in the form of decubitus, which began very early. The Babinski reflex was positive at the onset in cases 2 and 5, and toward the end of the disease in cases 1 and 3. The spinal fluid was always clear and under more or less increased pressure, with a small increase in the amount of globulin, a small increase in the number of cells and a positive reaction for sugar. Injections into animals gave negative results. Clinically, epidemiologically and pathologically, epidemic encephalitis and postvaccinal encephalitis are different; the former has diminished, and the latter increased, in frequency. Encephalitis following vaccination is in the group of para-infectious encephalitides, such as that of chickenpox, measles and smallpox; the great frequency in late years and the close similarity of the histologic pictures lend some plausibility to this view.

EMERSON, Boston.

POSTVACCINAL ENCEPHALITIS. R. PRIESEL and R. WAGNER, Ztschr. f. Kinderh. **49**:348, 1930.

The authors report three cases of postvaccinal encephalitis observed in Vienna in 1929, all in boys, aged 3¼, 4½ and 5½ years, respectively, who were vaccinated for the first time. In two cases the picture was that of meningitis, and in the third that of the cerebral form of infantile paralysis. The fall of the high temperature by lysis pointed to recovery. The spinal fluid showed an increased pressure and a positive test for sugar; one patient gave a positive reaction to all tests for globulin, another gave a negative reaction, and in the third patient a positive reaction to the Nonne test and a negative reaction to the Pandy test were obtained; in these cases, the cell count was normal, 11 and 211, respectively. The condition is hard to differentiate from tuberculous meningitis in the beginning, and requires an accurate history and a Pirquet test. All the patients had difficulty in speaking during convalescence. No case of encephalitis has ever been observed after an unsuccessful vaccination and there is no evidence that a secondary infection is the cause. The complication arises independently of the method of vaccination, and of the kind of animal from which the virus is derived. The quick return to health is surprising.

EMERSON, Boston.

Chronic Infections

THE CALCIFICATION OF TUBERCLES BY MEANS OF IRRADIATED ERGOSTEROL. TOM DOUGLAS SPIES, Am. J. Path. **6**:337, 1930.

The administration of repeated large doses of activated ergosterol to rabbits suffering from acute tuberculosis causes extensive deposition of calcium salts within the caseous lesions. The administration of a single large dose produces no demonstrable changes. It is suggested that a diet with a high content of vitamin D might be useful in some cases of pulmonary tuberculosis.

AUTHOR'S SUMMARY.

THE INCIDENCE OF CONGENITAL SYPHILIS IN AN INSTITUTION FOR THE FEEBLE-MINDED. CHARLES WOODALL, Am. J. Psychiat. **9**:1065 (May) 1930.

In examining more than 1,300 inmates of a colony for the feebleminded, Woodall found clinical and serologic evidence of syphilis in only 7 per cent. Furthermore, many of the patients with congenital syphilis showed a sufficiently defective heredity to account for the feeblemindedness on the familial basis alone. In the course of his serologic studies, the author found that the Hinton glycerol-cholesterol precipitation-agglutination reaction was more sensitive than either the Kahn or the standard Wassermann test. In spite of the low incidence of syphilis in this institution, Woodall believes that many cases of mental defect are caused by congenital syphilis, and he supports this conviction by citing statistics demonstrating feeblemindedness in 20 per cent of the families of those born with syphilis.

DAVIDSON, Newark, N. J.

LATE CONGENITAL SYPHILIS: REPORT OF A CASE. ANNA ELIJASZ, Arch. Dermat. & Syph. **22**:274 (Aug.) 1930.

A case of congenital syphilis in a girl, aged 18, is reported. It is of interest in that the outstanding features were: multiple changes in the bones—the remains of gummas manifested as rarefactions of bone tissue without destruction and ulceration—and a syphilitic glomerulonephritis exacerabated by intradermal injection of Busson's luetin and improved by active antisyphilitic treatment.

HARRISON, Iowa City.

THE CLINICAL VALUE OF BISMARSEN IN THE TREATMENT OF SYPHILIS. CHARLES H. DE T. SHIVERS, Arch. Dermat. & Syph. **22**:462 (Sept.) 1930.

Bismarsen, or bismuth arsphenamine sulphonate, a combination of two efficient antisyphilitic agents, is a new drug of low toxicity. It is easily administered and stable, and produces mild or no local reactions. In 152 cases of all types of syphilis in which 5,000 injections of bismarsen were given, dermatitis developed in only 2. Negative Wassermann reactions were obtained in 18 of 19 cases of primary syphilis after 20 intramuscular injections of 0.2 cm. of bismarsen. All of 200 patients gave negative serologic reactions after the first course of neoarsphenamine and potassium bismuth tartrate. The author advocates the latter treatment in primary syphilis. In 29 cases of early secondary syphilis, manifested by positive Wassermann reactions and cutaneous lesions, 2 failed to show serologic improvement after 20 injections of the bismarsen in contrast to 100 per cent results with neoarsphenamine and potassium bismuth tartrate. All but 1 of 11 cases of late secondary syphilis showed definite clinical improvement following the tenth treatment with bismarsen, and only 2 failed to manifest a serologic change after the twentieth injection. The author believes that there is no great need for immediate sterilization of patients in this stage. Because of the absence and infrequency of reactions connected with the use of bismarsen, he contends that it is the drug of choice. In 60 cases of tertiary syphilis with cutaneous lesions the results of bismarsen therapy paralleled those with neoarsphenamine and potassium bismuth tartrate. Of 18 cases with cardiovascular manifestations 66 per cent showed clinical improvement after the first course of 20 injections; 77 per cent were demonstrated to be improved after the second course of 12 injections. There were no reactions in this group of cases. Of 15 cases of cerebrospinal syphilis all showed definite clinical improvement; 33 per cent gave negative Wassermann reactions of the blood and 3, or 20 per cent, completely negative Wassermann reactions of the spinal fluid after the first course of 20 injections. The most marked improvement was seen in the acute meningeal type.

HARRISON, Iowa City.

B C G, Calmette and the League of Nations. Stephen J. Maher, M. J. & Rec. **132**:118 (Aug. 6) 1930.

At the International Conference on Tuberculosis held in Rome in 1929, the author found a surprising state of affairs. The question of B C G was the chief interest of delegates from all parts of the world. Should new-born infants be given a certain strain of live bovine tubercle bacilli in their milk in order to safeguard them from infection with tuberculosis? The controversy between the advocates and opponents was great. The most conspicuous debaters were Calmette and Petroff of Saranac Lake. Since then the author received a report (in French) of Calmette's argument before the Commission of the League of Nations. He translated this and gives it in detail. He reports the successful use of B C G in many countries; the least enthusiastic reports were from Great Britain and the United States. In Great Britain vaccinations were done in London, Glasgow, Leeds, Manchester and Cardiff without any untoward results. Some experimental work was done in Cambridge, and the workers all confirmed the harmlessness of B C G in experiments on animals. In the United States a conservative experiment was undertaken by W. H. Park, director of laboratories of the New York Health Department. His statement in a letter dated Aug. 24, 1928, is given in full. Other vaccinations were made at the New York Post-Graduate Medical School and Hospital by Dr. A. B. Boyless. Experimental researches were also carried out by Professor Marinoff of the University of Chicago.

Williamson, New Orleans.

Human Contagion and Tuberculous Infection in Childhood. Bernard Schlesinger and P. D'Arcy Hart, Arch. Dis. Childhood **5**:191 (June) 1930.

The investigation comprises a study of 118 London children who came from tuberculous households. This series was compared with 513 clinically nontuberculous children of the same district who came from nontuberculous households. The intracutaneous test (Mantoux) was used.

The author gives the following summary and conclusions: "1. Tuberculin reactions are more frequent among children of tuberculous households than among children whose homes are free of tuberculosis.

"2. Children living with a tuberculous parent or sibling show tuberculin reactions more frequently than children with tuberculous relatives who do not not live with them; and the latter more frequently than children with no tuberculous relatives.

"3. A larger percentage of reactors is found among children who are living with a relative suffering from open tuberculosis than when the tuberculosis is closed.

"4. These findings are adequately explained by variation in frequency, intimacy and duration of contact, without assuming the existence of inherted predisposition.

"5. In a small series of children, living with a parent or sibling who had non-pulmonary tuberculosis, tuberculin reactions were no more frequent than among children of non-tuberculous households, and children with no tuberculous relatives at all."

Kelly, Milwaukee.

The Roentgenologic Diagnosis of Congenital Syphilis. G. J. Landa and V. P. Panov, Ann. de dermat. et syph. **1**:867 (Aug.) 1930.

The authors found osseous lesions in every active case of syphilis in infants less than 1 year old. In children from 1 to 2 years of age, who had no clinical signs of syphilis but a positive Wassermann reaction, about half showed changes of a syphilitic type in the bones. In about 50 per cent of children under the age of 1 year, whose parents were syphilitic but who themselves showed no clinical or serologic evidence of the disease, syphilitic changes of the bones were found. In about 6 per cent of infants apparently free from syphilis and born of apparently

nonsyphilitic parents, syphilitic osseous lesions were revealed by roentgenologic examination. The authors conclude that in infants a complete examination for syphilis should include a roentgenographic study, as that examination, in some cases, gives more certain evidence than serologic tests. MICHAEL, Houston, Texas.

DETERMINATION OF RENAL INSUFFICIENCY IN CHILDREN AS A SIGN OF THE PROBABILITY OF HEREDITARY SYPHILIS. CASSOUTE, Bull. Soc. de pédiat. de Paris **27**:373 (July) 1929.

The determination of renal insufficiency in infants should be made more frequently, especially in those who show signs of hereditary syphilis. Frequently evidence of impaired renal function adds confirmation to the diagnosis of syphilis. Renal insufficiency, as determined by the ingestion of the albumin of six eggs or by the injection of 2 cc. of egg albumin, was present in 50 per cent of the children with syphilis that were tested. The Ambard coefficient shows renal impairment in about two thirds of children with syphilis. The phenolsulphonphthalein test usually shows the presence of altered renal permeability in patients with hereditary syphilis. BENJAMIN, Montreal, Canada.

TUBERCULOUS ADHESIVE PERICARDITIS WITH PASSIVE CONGESTION OF THE LIVER WITHOUT HEPATIC TUBERCULOUS LESIONS. CASSOUTE, POINSO and ALLIEZ, Bull. Soc. de pédiat. de Paris **27**:375 (July) 1929.

An Armenian boy, aged 2 years, presented marked abdominal symptoms: vomiting, progressive enlargement of the abdomen, diarrhea and an intermittent fever. The chief physical observations were an enoromus liver, ascites and an enlarged area of cardiac dulness; he also had rickets and showed spina ventosa of the third, fourth and fifth metacarpals with enlargement of the regional lymph glands, and infiltration of the apex and base of the right lung. At the end of three months he died during an attack of bronchopneumonia following measles. At necropsy the outstanding feature was the entire absence of any signs of tuberculosis in the huge liver, the enlargement of which was due altogether to passive congestion, although tuberculous foci were present in the heart, pericardium, lung, mediastinal lymph glands and kidneys. BENJAMIN, Montreal, Canada.

LOCAL SKIN TUBERCULIN REACTIONS: THEIR DIAGNOSTIC AND PROGNOSTIC VALUE. G. HUC, FITTE and DE WILLIENCOURT, Bull. Soc. de pédiat. de Paris **27**:409 (July) 1929.

The differential skin tuberculin reaction was obtained in a number of children suffering from tuberculous lesions and also in some children with conditions not due to tuberculosis. With exactly similar technic the test is performed (1) on the skin that covers the suspected tuberculous tissue or at least on that which overlies the lymphatic stream draining the suspected tissue, and (2) at some distance from, and outside of, the lymphatic stream draining the suspected tuberculous tissue. The reactions in each area are compared, preferably early, as they become so marked later in many cases that it is difficult to measure any difference. A hyperpositive reaction locally is frequently of value in confirming a doubtful diagnosis. A negative result locally may sometimes help to rule out the presence of a tuberculous process in certain lesions, e. g., traumatic or other nontuberculous lesions at the site of old healed tuberculous foci. The differential tuberculin test is also of value prognostically, as it is usually more marked over active lesions and less marked over healed ones. The condition of the skin where the tests are performed is of the utmost importance, as the presence of iodine or other antiseptics, ultraviolet exposure, etc., may alter the reactions and thus vitiate their significance in any particular instance. BENJAMIN, Montreal, Canada.

THE IMPORTANCE OF THE PSYCHIC FACTOR IN ACTIVATING PULMONARY TUBERCULOSIS. P. BRAUN and J. FREY-RAGU, Presse méd. **38**:962 (July 16) 1930.

The authors consider the psychic element of great importance in the lighting-up of pulmonary tuberculosis in susceptible adults and children. They mention particularly: sorrow, divorce, financial failure, family strife, thwarted ambitions, an improper daily regimen, examinations, worry, tuberculophobia and psychasthenia. A plea is made for peaceful, contented surroundings for contacts.

BIEKER, St. Petersburg, Fla.

CUTANEOUS LESIONS AND KERATITIS DUE TO CONGENITAL SYPHILIS IN A BOY, AGED 14. P. NOBÉCOURT, Progrès méd., Sept. 6, 1930, p. 1493.

A boy, aged 14, had ulcerated areas on the extremities and keratitis, both of which had developed in the last few months. The roentgenograms and Wassermann reaction were positive.

SANFORD, Chicago.

RARE FORMS OF HEREDITARY SYPHILIS AFFECTING THE EYE ALONE. A. SANTONASTASO, Ann. di ottal. e clin. med. **58**:117 (Feb.) 1930.

Two children in the same family, aged 2 and 5, showed blepharospasm, nystagmus, sluggish pupillary reactions, hyperopic astigmatism and pigmentary degeneration of the retina. The Wassermann reaction was positive in each case, but there were no other signs of syphilis. Cases in the literature presenting similar signs are reviewed. The author ascribes the nystagmus and blepharospasm to a cerebral lesion, and the retinal changes to a syphilitic chorioretinitis. He believes that even the refractive error may be the result of faulty development of the orbit as the result of syphilis. The combination of ocular symptoms was enough in these cases to suggest strongly hereditary syphilis, the presence of which was confirmed by the Wassermann reaction.

GIFFORD, Chicago.

ARTIFICIAL PNEUMOTHORAX IN THE TREATMENT OF CHILDREN FOR PULMONARY TUBERCULOSIS. RENATO PACHIOLI, Clin. pediat. **12**:281 (April) 1930.

A complete review of the literature on the therapeutic employment of artificial pneumothorax is given, together with the author's own experience. Covering his own work, he gives a detailed account of the factors that guide him in the selection of cases to which he applies this method of treatment.

He obtained satisfactory results in bilateral, as well as in unilateral involvement in chronic cases, and also in cases presenting the early stages of the disease.

Marked tracheobronchial adenopathy was considered as a contraindication to the use of artificial pneumothorax, as it resulted in failure to obtain improvement as well as in a harmful effect on the patient. Pleuritic lesions, especially in the form of adhesions of any extent, were also considered as contraindications.

A detailed explanation of the technic employed is given, which differs little from that used in the adult, with the exception of the frequent necessity of employing a moderate anesthesia, for which Pachioli uses ethyl chloride. For older children no anesthetic is required, and in many cases in which it is necessary for the first treatment it may be dispensed with in subsequent treatments as the child is easily taught to cooperate.

Complications are not more frequent than in the adult, the most frequent in the author's experience being the production of emphysema.

Though the number of cases is not adequate to permit giving a definite percentage of the number of cures obtained, the author is convinced that he has obtained satisfactory improvement in the physical manifestations of the disease as well as in the general welfare of the patient. Apparent complete cures have been noted, which, however, will require follow-up observations to establish the possible permanency of the cure.

Pachioli's work and observations indicate that in the use of artificial pneumothorax for children with pulmonary tuberculosis one has a comparatively safe weapon capable of causing marked improvement in the general condition of these patients and the apparent disappearance of the active lesions, if not a permanent cure.

SIGNORELLI, New Orleans.

THE PATHOLOGIC MECHANISM OF THE PSEUDOPARALYSIS OF PARROT. M. PEHU, Scritti medici dedicati a Carlo Comba, ediz., Riv. di clin. pediat., 1929, p. 87.

Pseudoparalysis of Parrot is the paresis seen in infants with congenital syphilis. The clinical characteristics of the condition are: (1) muscular weakness (occasionally true paralysis) seen in one or more of the extremities; (2) flaccidity when the arms are affected and spasticity when the legs are involved; (3) subjective pain in the limb, which, however, is not aggravated by motion; (4) osteochondritis and occasionally true epiphyseal separation, shown by roentgenograms and involving not only the limbs showing paralysis but all the long bones.

Parrot (1886) explained the mechanism of the paralysis on the lesion in the bone. Later other authors placed it in the nervous system. More recently Hochsinger (1928) placed the seat of the trouble in the muscles.

The main argument against the lesion of the bone as the cause is that the paresis is not in proportion to the extent of the process in the bone nor does it usually accompany it. The flaccidity of the paralysis of the arms and the spasticity of the paralysis of the legs are not in keeping with a nervous lesion. The different attachment of the muscles of the arm and legs in relation to the epiphysis may explain the difference in tonicity.

The author believes that pathologic alterations in the muscles are the basis of the clinical picture.

HIGGINS, Boston.

THE INTRADERMAL REACTION TO TUBERCULIN BY THE METHOD OF TRAMBUSTI. MAFALDA PAVIA, Scritti medici dedicati a Carlo Comba, ediz., Riv. di clin. pediat., 1929, p. 166.

The author has compared the results of tuberculin tests by (1) the Pirquet method, (2) the Mantoux or inunction method and (3) the Trambusti or intradermal method on 200 children. The results were as follows:

	Positive	Doubtful	Negative
Priquet	52	12	136
Mantoux	79	13	108
Trambusti	75	15	110

The intradermal test is as accurate as the Mantoux and much simpler and better adapted for routine use. The Pirquet test is not inhibited by simultaneous intradermal tests. The patients are not sensitized to tuberculin in from thirty-six to forty-eight hours by a Pirquet reaction.

HIGGINS, Boston.

GONOCOCCIC SEPTICEMIA WITH LARYNGEAL AND ENDOCARDIAL LOCALIZATION. JUAN C. NAVARRO, ENRIQUE A. PUEYRREDON and FELIPE DE ELIZALDE, Arch. argent. de pédiat. **1**:386 (Sept.) 1930.

A girl, aged 5 years, was the innocent victim of gonorrheal infection through contact with an infected adult. Following local improvement in the genital tract, a generalized gonorrheal sepsis developed. This was marked by severe arthritis, especially in the lower extremities, and a general petechial eruption all over the body. Aphonia, severe cough and dysphagia seemed to point to laryngeal involvement. At autopsy this was found to be due to suppuration of the small articulations of the laryngeal cartilages. Chronditis and perichondritis were present. Pus evacuated from these lesions and some of the joint lesions contained numerous gram-negative gonococci. Extensive endocardial involvement was also found.

SCHLUTZ, Chicago.

A Grave Case of Congenital Syphilis. R. da Rocha, Arch. de pediat., Rio de Janiero **2**:640 (June) 1930.

An infant had severe pseudoparalysis of Parrot in both wrists, with elevation of temperature and cutaneous lesions. Two injections of a suspension of bismuth salicylate oil, 0.5 cc. each, were given each week until twelve doses had been taken; these alternated with eight doses of an arsphenamine preparation. The Wassermann reaction then became negative and the clinical appearance was one of recovery.

Sanford, Chicago.

Changes in the Blood in Heredosyphilis and the Influence of Antisyphilitic Treatment. Emilio Gállego Berenguer, Med. de los niños **31**:46 (Feb.) 1930.

The majority of syphilitic children show a diminution of erythrocytes and a relative increase in leukocytes. The increase occurs in the following order; lymphocytes, mononuclear and polymorphonuclear eosinophils. The syndrome of pseudoleukemia is never present in its complete form. Antisyphilitic treatment rapidly restores the blood content to normal in the same order.

Dwyer, Kansas City, Mo.

Comparative Studies on the Cutaneous Reaction of Pirquet and the Percutaneous Test of Hamburger. H. Deuster, Deutsche med. Wchnschr. **56**:482 (March 21) 1930.

By the percutaneous tuberculin reaction of Hamburger the author means the Moro rubbing reaction modified by Hamburger. The site of inoculation was above the manubrium sterni. After the skin was cleaned with ether, a small amount of "percutaneous tuberculin of Hamburger" was rubbed into the skin by 100 circular movements of the index finger. The Pirquet test was performed in the usual way. Tests were performed on 1,527 children. The author found that the percutaneous reaction of Hamburger is as sensitive as the cutaneous test of Pirquet. For private practice and routine mass testing she prefers the Hamburger test. She admits, however, that in case of a negative reaction, the intradermal method should be used, before one excludes the possibility of tuberculosis.

Kereszturi, New York.

Acute Articular Rheumatism and Tubercle Bacillemia. C. Reitter and E. Löwenstein, München. med. Wchnschr. **77**:1522 (Sept. 5) 1930.

The etiology of acute arthritis during or following pneumonia, gonorrhea or syphilis is usually evident, but the cause of the large group of acute arthritides, generally called rheumatic, has not been found. In the joint exudate in fifteen cases of acute and subacute polyarthritis, Reitter demonstrated the presence of bacilli with the staining properties and morphology of tubercle bacilli. Moreover, Löwenstein obtained pure cultures of tubercle bacilli from the blood of twenty-six patients during the febrile stage of typical attacks of acute rheumatic polyarthritis. These observations open the question of the tuberculous etiology of all rheumatic infections and their complications, particularly rheumatic endocarditis. The abstracts of seven protocols are given. The ages ranged from 23 to 31 years, except for one patient who was 58 years of age. Three of the patients had had previous attacks of rheumatic arthritis. Some had chronic cardiac valvular disease and pericarditis. In three cases no tuberculin tests of the skin were done, but pulmonary tuberculosis was found in one of these. The Mantoux test (dosage not given) was negative in the other four. The patients improved after the administration of salicylates.

Blood for cultures was taken before salicylates were given. The technic for making the cultures is described.

Brahdy, Mount Vernon, N. Y.

THE CLINICAL SIGNIFICANCE OF TUBERCLE BACILLEMIA. E. LÖWENSTEIN, München. med. Wchnschr. **77**:1662 (Sept. 26) 1930.

Löwenstein describes his method for culturing tubercle bacilli. He obtained pure cultures of tubercle bacilli in afebrile as well as febrile stages of various forms of tuberculosis. In several obscure diseases of the skin the etiology was settled by obtaining a pure culture of tubercle bacilli from the blood. The author thinks that metastatic manifestations in tuberculosis do not result from a single shower of bacilli, but rather that a chronic bacillemia exists. A method that gives direct evidence of bacilli in the blood may be more valuable in diagnosis than the tuberculin test of the skin.

BRAHDY, Mount Vernon, N. Y.

SEPTICEMIA IN TUBERCULOSIS WITH PARTICULAR REFERENCE TO A PURE CULTURE OF TUBERCLE BACILLI DERIVED FROM THE BLOOD (METHOD OF LÖWENSTEIN). R. RUSSEW, Wien. Arch. f. inn. Med. **10**:231 (June) 1930.

The author has been successful in growing tubercle bacilli from cultures of the blood by the method of Löwenstein.

The bacillus is demonstrable in the blood by this method in (*a*) severe pulmonary tuberculosis, (*b*) less frequently in mild degrees of pulmonary tuberculosis and (*c*) in metastatic tuberculosis; in six of eight cases of metastatic tuberculosis the demonstration of tubercle bacilli was successful, although the patients were afebrile, and their general condition was excellent.

A positive culture gives no clue to prognosis. In conditions of prolonged fever of obscure origin, with tuberculids, choroiditis or metastatic tuberculosis, the urine should also be examined for tubercle bacilli, and the eyegrounds carefully searched. An effort to grow bacilli in pure culture from the blood should always be made.

SCHLUTZ, Chicago.

ARTHRITIS DEFORMANS JUVENILIS. J. C. SCHIPPERS, Nederl. maandschr. v. geneesk. **17**:27, 1930.

The author describes four cases of primary chronic arthritis or arthritis deformans juvenilis, a disease of which only in recent years cases have more frequently been observed and described in different countries. The disease may appear before the second year of life. The heart is almost never affected, and the other symptoms accompanying polyarthritis rheumatica are also absent. Symptoms in the joints and periods of intermittent elevation of temperature prevail in this clinical picture. The author discusses the several theories about the cause of the disease. It is unknown which organism is the cause of the disease and whether the cause is always the same. Still's disease is probably a peculiar form of arthritis deformans juvenilis. Next to diseases of the nose and throat and extensive dental caries, disease of the tonsils is especially regarded as the origin of arthritis deformans juvenilis; tonsillectomy is therefore often performed in cases of this disease. The result, however, is very different. Medicines are of little help, their effect being difficult to judge, owing to the occurrence of peculiar spontaneous improvements. In Holland the great scarcity of cases of arthritis deformans juvenilis is in striking contradiction to the great frequency of diseased tonsils, inflammation of the nose and throat and dental caries.

VAN CREVELD, Amsterdam.

THE KOCH BACILLUS IN BASILAR TUBERCULOUS MENINGITIS. JAROSLAV PROCHASKA, Časop. lék. česk. **67**:606 (April 20) 1928.

After a brief review of the literature the author cites fifty-seven cases of basilar meningitis in which the bacillus was found intra vitam. In forty-four of these cases the diagnosis was confirmed by section; six patients died after leaving the clinic and seven were lost sight of. The method consists of attempting to

stretch the pellicle on the microscopic slide as it begins to separate from the sides of the test tubes and before it settles. When this is impossible the pellicle is crushed, and Ziehl-Neelsen and methylthione chloride staining is used. In early cases with a symptom-complex of from five to seven days 73.3 per cent gave a positive reaction at the first puncture, 13.3 per cent at the second and 13.3 per cent at the fourth puncture in a series of fifteen cases. In thirty-seven cases with symptoms lasting more than seven days, thirty-three gave positive results on the first puncture and four on the second. In eight cases of three weeks' duration six gave positive results on the first puncture and two on the second puncture. On the basis of these observations, the author suggests a change in terminology to meningitis cerebrospinalis tuberculosa. A positive diagnosis should be made only on the finding of the organism. Those cases in which no organisms are found after diligent search should be considered serous meningitis.

STULIK, Chicago.

Internal Diseases

ERYTHROBLASTOSIS WITH CONGENITAL UNIVERSAL HYDROPS. W. C. HUEPER and M. C. MULLEN, Am. J. Obst. & Gynec. **19**:831 (June) 1930.

The authors review the literature of true hydrops in the new-born, and agree with Rautmann and Chiari that it is due to an erythroblastosis of unknown origin.

In the cases that they report there was marked edema of all structures. The red cells included 35 per cent nucleated erythrocytes, predominantly erythroblasts and megaloblasts. The differential count revealed 82 per cent myeloblasts, 14 per cent neutrophilic myelocytes, 3 per cent eosinophilic myelocytes and 1 per cent lymphocytes. The bulk of the liver substance was made up of large numbers of myeloid cells lying between and compressing the liver cells. The lymphoid tissue in the spleen was completely replaced by myeloid tissue.

The authors believe that since the mother of this infant had previously given birth to a normal child, but later had had a series of miscarriages culminating in the birth of this patient, some injury to the spermatozoa or ova had occurred following the normal birth.

ALLEN, Chicago.

THE PHYSIOLOGICAL BASIS FOR MECHANO-THERAPEUTICS IN HEART DISEASE. EDGAR CYRIAX, Internat. Clin. **2**:15 (June) 1930.

Patients may be treated by movements such as local treatment over the precordium, shoulder hacking (tapotement), respiratory exercises, abdominal petrissage, local and general massage, direct stimulatory nerve treatment on the cerebrospinal, vagus and sympathetic nerves, resisted movements and passive movements at joints. Local treatment may consist of stroking (effleurage), vibrations or tapotement. Such changes as slowing of the heart rate and change in the size of the heart are noted. The general condition of cardiac patients is often greatly improved. The effect is due partly to reflex action on the vagus and sympathetic nervous systems.

MILLER, South Bend, Ind.

FOCAL INFECTION AND ELECTIVE LOCALIZATION. EDWARD C. ROSENOW, Internat. Clin. **2**:29 (June) 1930.

The significance of foci of infection in the causation of disease is determined by noting: (1) the incidence of foci in patients suffering from various diseases; (2) the clinical improvement following the removal of foci; (3) the elective localizing power in animals of the bacteria isolated from foci and systemic lesions; (4) the serologic reactions of strains isolated from foci and from specific lesions in patients and those produced in animals, and (5) the microscopic evidence of the causative organisms in the tissues containing foci and systemic lesions. A detailed description of the methods used and the results obtained are given.

MILLER, South Bend, Ind.

HYPERTHYROIDISM IN CHILDREN UNDER 10 YEARS OF AGE. H. C. MILLER, Nebraska M. J. **15**:363 (Sept.) 1930.

The author gives a brief review of the reported cases of hyperthyroidism in children. Comparatively few reports are available. No definite factor in the etiology is suggested; infection plays the largest rôle. The symptoms in childhood do not differ materially from those in the adult, the first symptoms noticed usually being nervousness and increased irritability, then tachycardia and dyspnea on exertion. Enlargement of the thyroid gland and tremor are usually not observed until later. Exophthalmos was present in the four cases reported — in one instance as early as the second year. Loss of weight is less marked in the young child than in the adult. Failure to gain, however, is noticeable. Medical, hygienic and dietetic measures should be employed before operation, on account of the important rôle played by the thyroid in the physical and mental development of the child. Three of the author's patients were treated with iodine, dietetic and hygienic measures and radiation with actinic light. After improvement, chronically infected tonsils and adenoids were removed. The author points out the danger of early operation, such as tonsillectomy, in the presence of severe toxic goiter. One of his patients experienced profound disturbances following a tonsillectomy; he was comatose for ten days, his pulse could not be counted, and pneumonia developed with resulting empyema, for which drainage was performed. The basal metabolic rates in these four cases were 46, 38, 54 and 59, respectively. The basic metabolic test should be made in the nervous, irritable, overactive child with tachycardia and stationary or diminished weight. These symptoms should always be regarded as being of possible thyroid origin.

HAMILTON, Omaha.

VULVOVAGINITIS IN CHILDREN. FREDERICK J. LYNCH, New England J. Med. **202**:1251 (June 26) 1930.

Vulvovaginitis is often spread by towels, napkins, soap, bed linen, toilet seats and by some infected member of the family. A positive smear and local signs are enough evidence for a diagnosis. The disease shows little tendency to ascend, but the cervix is often infected. Patients with the disease should be hospitalized and isolated if the gonococcus is the causative organism; they should receive a tub bath and a change of underclothing daily and a 2 per cent mercurochrome-220 ointment should be applied daily until smears have been negative for at least two weeks. In some cases vaccine therapy is definitely indicated, and is most effective when made from a female child suffering from the disease. The period of illness is much shortened by this plan of treatment.

GENGENBACH, Denver.

EGGS AND LARVAE OF COMMON HOUSE FLY FOUND IN HUMAN INTESTINE. MARVIN SMITH, South. M. J. **23**:576 (July) 1930.

The eggs and larvae of *Musca domestica*, or the common house fly, can and do exist in the human intestine without regard to the reaction of the feces.

The eggs are ingested on foods, either cooked or raw, on which flies alight even for an instant. Many eggs remain in the human digestive tract long enough to hatch and develop into full-sized larvae. The larvae probably remain more or less indefinitely hidden in the folds of the mucous membrane of the colon.

Every human being who eats food on which flies have alighted is susceptible to this condition. The eggs and larvae are much more prevalent during the active laying season of the fly, from April to September.

Oil of chonopodium followed by a saline cathartic is fairly effective in removing them. The magot is omnivorous, and its enteron has been found filled with red blood cells.

Every patient observed from whom the larvae were removed suffered from marked secondary anemia.

SCHLUTZ, Chicago.

THYMUS. DOUGLAS D. MARTIN, South. M. J. **23**:625 (July) 1930.

The author advises against hasty resort to roentgen therapy in every case of enlarged thymus with respiratory stridor, before careful clinical observation has been made for other possible causes.

He suggests that thymic enlargement be considered not so much a distinct clinical condition as the result of other pathologic conditions. The closest cooperation between the roentgenologist and the pediatrician is desirable.

SCHLUTZ, Chicago.

SOME OBSERVATIONS ON THE THYMUS IN EARLY INFANCY. E. H. SHANNON, Canad. M. A. J. **22**:775 (June) 1930.

An excellent review is given of the most recent data concerning the anatomic and histologic structures of the thymus as well as the prevailing theories as to the production of the thymic syndrome. Shannon draws the following conclusions from his own work:

1. Examination of 119 infants of varying ages—76 of whom were under 1 day, and 43 slightly under 4 days, of age—showed a thymus chest ratio of 1:2.08, the ratio being between the transverse diameter of the thymus at the level of the third dorsal vertebra and the external diameter of the chest at the same level.

2. Fifty infants of about the same average age, referred with clinical signs of thymic disease, showed a thymus chest ratio of 1:2.07.

3. The presence of a large thymus shadow on the roentgenogram has no direct interpretation in terms of disease or clinical symptoms, and the clinical manifestations should be the sole index as to the advisability of treatment.

4. A study of thirty-three infants whose thymus at birth measured 3 cm. or more showed an average diminution of 0.55 cm. in the transverse diameter of the gland in the first three and a half days of postnatal life.

5. A study of roentgenograms of the chest of seventy-three infants, of from 3 to 7 days of age, showed a thymus chest ratio of 1:2.5. The knowledge of this ratio is of limited diagnostic value.

Dr. Shannon makes the point that radiation constitutes a therapeutic test in cases showing symptoms thought to be due to the thymus.

MOORE, Omaha.

AGRANULOCYTOSIS. A. W. JACOBSEN, Canad. M. A. J. **22**:814 (June) 1930.

The author reports two cases of infection producing agranulocytosis in children. In the first case, which occurred in a white girl, aged 1½ years, the important points in the symptomatology and physical examination were development of purpuric spots from slight trauma, infection of the left upper eyelid with marked swelling and a serosanguineous discharge. Later small ulcerated bleeding areas developed in the mouth. A low grade temperature of 100.5 F. persisted. The blood examination showed: red blood cells, 1,170,000; hemoglobin 19 per cent; white blood cells, 3,400; polymorphonuclears, 8 per cent; lymphocytes, 90 per cent; large mononuclears, 2 per cent, and platelets, 56,000. Transfusions gave only temporary relief. A detailed report is given of the pathologic observations made post mortem.

In the second case, that of a white girl, aged 4 years, the important observations were: large deep ulcerations of the pharynx, signs of pleural effusion and pneumonia, anasarca and an enlarged liver. The blood count showed: white blood cells, 1,300; polymorphonuclears, 5 per cent, and lymphocytes, 95 per cent (2 per cent nucleated red cells). No autopsy was obtained.

The author concludes that a review of the cases reported in the literature indicated that agranulocytosis is the result of the action on the bone marrow of a variety of different poisons, such as benzene, arsphenamine and toxins of bacteria. Ulcerative infections of the mucous membrane are often but not invariably present.

Agranulocytosis is apparently closely related to aplastic anemia, purpura, monocytic angina and possibly infectious mononucleosis.

MOORE, Omaha.

PHENYLETHYLHYDANTOIN IN THE TREATMENT OF CHOREA. C. F. T. EAST and E. R. CULLINAN, Lancet **2**:190 (July 26) 1930.

This study is based on experience in fifteen cases of chorea varying in degree from mild to severe and occurring in patients from 6 to 21 years of age.

The triad, (1) fever, (2) quickened pulse rate and (3) rash, appeared only four times. Rash was noticed in only eight cases and drowsiness in six cases, amounting practically to coma in two instances. Improvement took place from eight to fourteen days after starting treatment with phenylethylhydantoin. The two patients who did not improve showed no response of any sort to the drug. The dosage was 0.3 Gm. twice daily for periods varying from six to fifteen days. The largest total amount given was 7.2 Gm. No note was made of the blood reaction in these cases, e. g., leukopenia or eosinophilia.

"The symptoms of chorea are improved and the attack is cut short in quite a dramatic manner in many instances. The question is whether it is right to use a drug which can produce so variable and uncertain a reaction to treat a disease which is said to be self limited. The main justification would rest upon demonstration that the abolition of chorea prevented the onset of carditis."

LANGMANN, New York.

RHEUMATISM IN CHILDHOOD. W. SHELDON, Lancet **2**:394 (Aug. 23) 1930.

This report is based on the study of 600 consecutive cases of rheumatism at the Rheumatic Clinic of the Hospital for Sick Children, Great Ormond Street. Sufficient parallelism was noted between the incidence of rheumatic pains and the rainfall to warrant further investigation. The earliest occurrence of rheumatic arthritis was in a child aged 2½ years. The shortest interval between attacks of rheumatic fever was 6 months. Of 197 cases of chorea, heart disease was found in 52. It was noted that children in whom chorea is likely to develop are almost always quick and intelligent. Six months away from school should be the minimum period for a choreic child (no mention is made of drug therapy, e. g., with phenylethylhydantoin). Of the 600 rheumatic children, 266 were found to have heart disease.

The author calls particular attention to the mid-diastolic murmur, heard a little internally to the apex beat, as a valuable sign of organic heart disease. He maintains that mitral stenosis does not develop for several years after the original attack of endocarditis, the shortest period in the cases analyzed being three years.

Tonsillectomy did not give encouraging results as to occurrence or recurrence of rheumatic manifestations (as also reported by other investigators). The author concludes that "the tonsils of rheumatic children should not be removed unless there is evidence that they are affecting the general health adversely."

LANGMANN, New York.

A SHORT COMMUNICATION ON THE X-RAY APPEARANCE PRODUCED BY FOREIGN BODIES IN THE CHEST IN CHILDREN; FIVE ILLUSTRATIVE CASES. V. E. NEGUS, Proc. Roy. Soc. Med. **23**:987 (May) 1930.

The author considered that cases of a nonopaque foreign body were rare because they were not always recognized. It is important to obtain a history of the accident and ascertain its date; even when this is done, there may be difficulty in diagnosis.

Five cases with roentgenograms are given in the report: (1) nonreturn valve obstruction of the right bronchus by a piece of Brazil nut in a girl, aged 10 years; (2) nonreturn valve obstruction of the right bronchus by a nut in an infant, aged 1½ years; (3) a metal clip in the left bronchus of a boy, aged 7 years; (4) a screw in the left bronchus of a boy, aged 4 years, and (5) a piece of carrot in the bronchus of the lower lobe of the left lung in an infant aged 1 year and 10 months.

WILLIAMSON, New Orleans.

PULMONARY FIBROSIS. W. SHELDON, Proc. Roy. Soc. Med. **23**:999 (May) 1930.

A boy, aged 3 years, gave a history of having had bronchopneumonia at the age of 12 months. On examination the child was slightly cyanosed; the heart was displaced to the left. The apex beat was in the left anterior axillary line. The percussion note over the lungs was equal and resonant, but there was bronchial breathing over the lower lobe of the left lung, and crackling crepitations were present. The fingers and toes were not clubbed. The child was often breathless, particularly when he was lying down. The sputum was small in amount, and the odor was not offensive.

WILLIAMSON, New Orleans.

HAEMOPHILIA WITH HAEMARTHROSIS OF KNEE JOINT. H. A. T. FAIRBANK, Proc. Roy. Soc. Med. **23**:1000 (May) 1930.

A boy, aged 9½ years, complained of painful swelling of the right knee joint following an accident. He was the only child and had suffered from hemophilia since he was 10 months of age. He had suffered from attacks of epistaxis, hematuria, hematemesis and melena. Hemophilia could be traced back for six generations. On admission to the hospital there was a fusiform swelling of the right knee. The skin was hot, and the joint was painful. There was moderate infusion into the joint. The quadriceps was wasted, and the joint was held in flexion. A roentgenogram showed backward displacement of the tibia. The blood picture was reported.

WILLIAMSON, New Orleans.

"IDIOPATHIC" HEPATIC CIRRHOSIS WITH RECURRENT JAUNDICE. F. PARKES WEBER and M. SCHOLTZ, Proc. Roy. Soc. Med. **23**:1109 (June) 1930.

A girl, aged 12 years, was admitted to the hospital with a slight attack of jaundice of the obstructive type with a positive direct van den Bergh reaction for bilirubin in the blood serum. The urine contained an excess of urobilin and urobilinogen but no bilirubin. The galactose test showed an improvement of hepatic function. The patient gave a history of recurrent or remittent jaundice. There was nothing special in the family history. All other tests were negative. Under treatment the jaundice gradually disappeared.

WILLIAMSON, New Orleans.

ON THE CLINICAL SIGNIFICANCE OF RIGHT BRANCH BUNDLE BLOCK. FRANCIS BACH, Quart. J. Med. **23**:261 (April) 1930.

The author studied eighty cases of branch bundle block clinically and electrocardiographically. Etiologically, they fall into three groups: (1) the cardiovascular degenerative, (2) the syphilitic and (3) the rheumatic.

In the first group, containing the majority of the cases, the prognosis is reasonably good. In the syphilitic group, it is poor. In the third or rheumatic group, which is composed chiefly of younger people, the prognosis, according to the author, is good.

BRADFORD, Rochester, N. Y.

THE AETIOLOGY AND PROGNOSIS OF AURICULAR FIBRILLATION. HAROLD COOKSON, Quart. J. Med. **23**:309 (April) 1930.

The author presents clinical evidence concerning the effect of certain factors related to auricular fibrillation on the prognosis in this condition. Auricular fibrillation is associated with three types of heart disease: (1) rheumatic heart disease, (2) the arteriosclerotic, or nonrheumatic type, and (3) the toxic thyroid type. The expectation of life is greater in those cases in which the fibrillation is associated with factors merely related to age, i. e., the arteriosclerotic type.

In the rheumatic type, the relation between age and prognosis is examined. In twenty-three fatal cases in which fibrillation began between the twelfth and

seventeenth years the average duration of life was ten months. Treatment afforded no relief in these young persons. After the second decade, the age of onset of fibrillation has little effect on the prognosis.

Cerebral embolism, an important complication of mitral stenosis, occurred as frequently when the rhythm was normal as when there was fibrillation.

When partial block is present, apart from treatment, the outlook for the patient with fibrillation is better. When complete block exists, fibrillation of the auricles does not appear to increase the gravity of a case; when the two disorders are combined, attacks of Adams-Stokes' disease have rarely occurred.

Auricular oscillations of the electrocardiogram are generally smaller in the nonrheumatic than in the rheumatic type. There is little evidence of any relation between the duration of fibrillation and the amplitude of these waves.

Infective endocarditis and auricular fibrillation are common sequelae of rheumatic carditis, but are rarely combined.

BRADFORD, Rochester, N. Y.

CRITICAL REVIEW: DISSEMINATED SCLEROSIS. W. RUSSELL BRAIN, Quart. J. Med. **23**:343 (April) 1930.

In an excellent treatise of forty-four pages, Brain presents a detailed review of disseminated sclerosis. The disease is discussed under the following heads: (1) Introduction, (2) Distribution and Incidence, (3) Pathology, (4) The Pathogenesis of Disseminated Sclerosis, (5) Experimental Transmission and Bacteriology, (6) Symptomatology, (7) Treatment and (8) Relationship to Other Diseases.

The review of the work in experimental inoculation in animals and the bacteriology is especially interesting. A description of the recent work of Chevassut with spherula insularis and of the relationship of these bodies to the disease is presented. A list of 218 references accompanies the monograph.

BRADFORD, Rochester, N. Y.

BRONCHIAL DILATATION IN CHILDREN PRESENTING A PICTURE OF MEDIASTINAL PLEURISY. J. J. LEUNDA and A. CARRAU, Arch. de méd. d. enf. **33**:347 (June) 1930.

The authors present four cases in which the roentgenograms of the chest might readily be interpreted as mediastinal pleurisy, but which the use of iodized poppy seed oil 40 per cent clearly demonstrated to be bronchial dilatation. The cardiodiaphragmatic shadow of Chauffard, believed to be pathognomonic of pleurisy involving the mediastinum, is thus shown to be indicative of other conditions. Injections of iodized oil appear to constitute the only scientific method of differentiation, in view of the great difficulty of making a positive diagnosis of bronchiectasis in children from clinical observations alone or even from ordinary roentgenograms.

AMESSE, Denver.

RENAL INFANTILISM. VLADIMIR MIKULOWSKI, Rev. franç.de pédiat. **6**:226, 1930.

The author reports a case of renal infantilism in a boy, aged 10 years, who, although he was mentally his age, had the physical development of a boy of 6 years. For four years he had shown nephritis, characterized by hematuria, retention of chlorides without edema, an acidosis without nitrogen retention and an inability to concentrate the urine. The author suggests that an endocrine rôle might be ascribed to the kidney, which had been injured.

LESLIE, Evanston, Ill.

ACUTE GLOMERULONEPHRITIS COMPLICATING EPIDEMIC PAROTITIS. AMOS FOA, Pediatria **38**:841 (Aug 1) 1930.

A case of acute glomerulonephritis complicating acute epidemic parotitis (mumps) in a child 9 years of age is reported. Following a sudden and severe

onset, the nephritis showed a benign course; complete recovery occurred within three months.

The author calls attention to the rarity of this complication. He covers in detail its clinical and anatomicopathologic characteristics, and especially stresses its etiology. Mumps should be considered septic and should be guarded against.

SIGNORELLI, New Orleans.

Nervous Diseases

THE PRACTICAL APPLICATION OF A MENTAL HYGIENE CLINIC (PROGRAM). NOBLE R. CHAMBERS, New York State J. Med. **30**:840 (July 15) 1930.

Work in mental hygiene began in Syracuse in 1914 when a neuropsychiatric clinic was established in the Free Dispensary. With this clinic as a nucleus, the work has grown, and the city now has a satisfactory program for mental hygiene. It includes work with preschool and school children, child guidance clinics, neuropsychiatric clinics, child-placing facilities and juvenile court work. The author tells how cooperation has been secured from many agencies. He believes that the experiences in Syracuse will be of value in guiding other communities in similar problems.

AIKMAN, Rochester, N. Y.

ELECTROLYTIC EQUILIBRIUM AND CELLULAR PERMEABILITY. EXPERIMENTAL STUDY AND CRITICAL CONSIDERATIONS OF THE PATHOGENESIS OF SOME FORMS OF TETANY. I. SPADOLINI, Scritti medici dedicati a Carlo Comba, ediz. Riv. di clin. pediat., 1929, p. 131.

The author found that there are alterations in the mucous membranes of the body (a change in cellular permeability) in association with deprivation of the parathyroid function. This is doubtless a factor in the production of tetany. Another factor in the production of tetany is toxemia, usually bacterial in origin. In experimental observations there was a definite diminution in the calcium of the blood in parathyroidectomized animals and also in normal animals following the injection of a bacterial filtrate.

Toxemia probably plays an important rôle in the appearance of idiopathic tetany which sometimes accompanies rickets.

HIGGINS, Boston.

MENINGITIS DUE TO THE PFEIFFER BACILLUS. MARIA PLACE, Arch. de pediat. d. Uruguay **1**:478 (Sept.) 1930.

In a breast-fed infant, aged 6 months, purulent meningitis due to the bacillus of Pfeiffer developed. The case terminated fatally.

SCHLUTZ, Chicago.

COMPLETE SOFTENING OF BOTH CEREBRAL HEMISPHERES IN AN INFANT AGED TWO MONTHS. F. SCHOB, J. f. Psychol. u. Neurol. **40**:365 (May) 1930.

Within a few hours after birth, an infant was admitted to the Municipal Hospital in Dresden with its mother, who was suffering from florid secondary syphilis. The infant was born at full term, was strong and well developed and was without visible signs of syphilis; it was 51 cm. in length; the circumference of the cranium was 36 cm., and its weight was 3,250 Gm. A Wassermann reaction of blood taken seven days after admission was negative. The infant was breast fed and increased steadily in weight until the thirty-sixth day after admission, when a temperature of 38 C. (100.4 F.) and loose green stools developed. During the next three days, with the persistence of the diarrhea and the fever the appetite became poor, and the infant began to lose weight. On the thirty-ninth day, there appeared tonic seizures of the muscles of the neck and of all four extremities. During these seizures, which lasted from one-half to one minute, the face appeared bluish red and the head was held in extension and to the right with deviation of both eyes

to the same side. Any attempt to rotate the head to the left was followed by a spontaneous rotation back to the right. The legs were in flexion, and passive extension met with great resistance and was apparently painful. At times the left palpebral fissure was wider than the right; at other times the right was wider than the left. The pupils were equal in size and reacted to light. There was no nystagmus and no Chvostek sign. The deep reflexes were normal.

Although the infant showed no evidences of syphilis, owing to the mother's severe syphilitic infection, it was subjected to three prophylactic injections of sodium arsphenamine (0.0225 Gm.). The fever, however, as well as the seizures, loss of appetite, diarrhea and loss of weight, persisted till the fifty-fifth day after admission when the seizures ceased. During the next ten days the infant was semicomatose and marasmic; it died on the sixty-fifth day after birth.

Necropsy revealed a high degree of marasmus, complete absence of fat and evidences of severe gastro-enteritis. The viscera, meninges, blood vessels and cranial nerves were normal. Both cerebral hemispheres appeared like two flabby bags; the external configuration of the brain was still recognizable although the convolutions felt soft. The entire surface of the brain was of a light yellowish tinge. On horizontal section there exuded from both hemispheres a grayish-yellow, pastelike, fatty, fluid substance. After washing out this fluid the entire white substance of both hemispheres seemed to have disappeared in some areas, while the remaining areas were soft so that the entire brain was replaced by a cavity that was traversed by a network of the cerebral vessels. The parts of the central ganglions adjacent to the walls of the ventricles also seemed to have participated in the softening. The cerebellum, crura cerebri, medulla oblongata and spinal cord showed no gross abnormalities.

Histologic examination revealed an extensive nonpurulent process consisting of a chronic inflammation of the pia, with numerous lymphocytes and plasma cells, and of small nodular granulations around the vessels and in the substance of the brain and cerebellum. These granulations appeared as focal nodules and consisted partly of fibroblasts and partly of glia cells interspersed with plasma cells. Although spirochetes could not be demonstrated in any of the tissues, the presence of small granulomas consisting of giant cells and of plasma cell infiltrations and the positive history of syphilis in the mother led the author to regard the condition as one of meningo-encephalomyelitis syphilitica congenita (Ranke).

Although Schob makes this diagnosis, he raises the question whether the softening was actually due to congenital syphilis. He is certain that it could not have been due to endarteritic changes with closure of the vessels by thrombi, because such vascular changes were not found on histologic examination. Whether or not such softening could have been produced by the toxin of syphilis is not definitely known, although it is common knowledge that, for example, in dementia paralytica in adults, there may occur less marked softenings in the brain in the form of a status spongiosus of the cerebral cortex. Nor is it definitely known whether or not the immature tissues of the new-born infant may not react to such toxins more readily than the mature tissues of the adult. Schob is also unable to exclude positively the possibility of trauma to the brain during birth which in the presence of syphilis may subsequently give rise to more advanced softenings in the traumatized areas. Finally, it may also be possible, as the first cerebral manifestations (the seizures) appeared simultaneously with the onset of gastro-intestinal disturbances, that toxins from the latter cooperating with an already existing injury to the cerebral tissue and vascular apparatus from syphilis could also produce such severe lesions in the brain. In this connection the author also points out the impossibility of determining definitely whether or not the gastro-intestinal symptoms could be regarded as a secondary general manifestation of severe disease of the brain.

Schob thus shows that in spite of the progress of knowledge of the effects of cerebral birth trauma, there is little positive knowledge of the etiology and genesis of cerebral softenings in the new-born infant and of porencephalus in general. In a previous communication he had already shown that by far the greater number

of porencephalies begin during intra-uterine life, before the completion of the sixth embryonal month, because many of these porencephalies are associated with malformations, such as microgyria and heterotopies, which could only have developed before the sixth embryonal month. He admits, however, that it is not at all rare to encounter cases of porencephaly that apparently had not appeared until a considerable period after birth. The etiology and genesis of these cases still await explanation.

KESCHNER, New York.

FAMILIAL RETARDATION OF SPEECH. M. SEEMANN, Časop. lék. česk. **67**:64 (April 27) 1928.

The author feels that the study of retardation of speech is important from the standpoint of the etiology of deaf-mutism, which is given as alcoholism, consanguinity, tuberculosis, syphilis, cranial rickets and heredity. Because deaf-mutism is regarded as a functional disease, cases of anatomic defect or defects of the speech center or the auditory apparatus were not included. In all, 337 children with retarded speech were studied; 153, or 45.4 per cent, were imbeciles; 79 of these talked between 2 and 3 years and 74 between 4 and 14 years; 20 had cleft palate, and 17 of these talked between 2 and 3 years and only 3 after 3 years of age. The fourth group, numbering 169, was divided as follows: 15 born in abnormal positions of whom 3 were subsequently classed as imbeciles, 55 who subsequently stuttered, 62 who had no familial history of slow talking and 35 who had a definite family history (22 or more than half of these were boys). In several of the families speech was delayed in 3 generations, and in 1 instance 9 members of 1 generation were afflicted.

STULIK, Chicago.

Diseases of the Eye

DESTRUCTIVE PURULENT OPHTHALMIA ACCOMPANYING AN ERUPTIVE FEVER WITH STOMATITIS. J. M. WHEELER, Am. J. Ophth. **13**:508 (June) 1930.

In a Jewish boy, aged 8 years, generalized aches and pains developed after he was caught in the rain. Two days later, his eyes became infected, his nose and mouth were dreadfully inflamed, and a rash broke out. A diagnosis of erythema, possibly of drug origin, was first made. Dr. A. M. Stevens diagnosed the condition as one described by him and F. C. Johnson, in 1922, under the title "A New Eruptive Fever Associated with Stomatitis and Ophthalmia." The patient's eyelids became swollen shut, with pus streaming from them. The nares were excoriated, and heavy, dark crusts and fresh blood were adherent to the lips. Brownish spots were scattered over the body. The temperature ranged from 98 to 101 F. and the pulse rate from 80 to 120. Urinalysis, examination of the blood and the Wassermann test gave negative results. Both corneas became ulcerated so that the iris could not be seen. Culture of a smear from the eye showed short chain, nonhemolytic streptococci and gram-negative diplococci, probably not gonococci. Both corneas perforated, and sight was destroyed in one eye and almost so in the other. The author discusses the possible diagnosis and suggests a distinct disease not hitherto recognized.

REESE, Philadelphia.

A PECULIAR FORM OF CONGENITAL CATARACT. N. COLLEVATI, Saggi di oftal. **5**:391, 1930.

The author saw this condition in a mother and two sons. The opacity was almost identical in the three cases, and consisted of a series of spicules extending from the anterior embryonal sutures, with their peripheral ends broadening into a truncated conical shape. Vision varied from 8/10 to 3/10, the difference depending on slight variations in the size of the opacity. In addition, the mother showed some opacities in the anterior cortex of the coronary type. Since the central opacities were confined to the embryonal nucleus, they must be considered to have

formed some time before birth. Careful examination of the blood chemistry disclosed a hypocholesterinemia in all cases, which suggests to the author a change in lipoid metabolism, possibly due to some disorder of the liver.

GIFFORD, Chicago.

VACCINOTHERAPY IN OPHTHALMIA NEONATORUM. L. MAMOLI, Saggi di oftal. **5**:417, 1930.

Thirty-one patients were treated with four kinds of gonococcal vaccines, some also containing other organisms. Details of eight especially severe cases, in which the cornea was involved before treatment, or which were not influenced by other treatment, are given; in the other cases an uneventful course was observed. Only the patients showing a febrile reaction seemed to benefit by the vaccine. In one case a corneal ulcer developed in spite of the vaccine, which caused no febrile reaction, but improvement occurred after the administration of a nonspecific protein, which produced fever. In other cases, large doses, 100,000,000 organisms or more, were necessary to produce the desired effect. The author believes that the use of specific vaccines has the advantage over nonspecific protein therapy in producing not only a first nonspecific reaction but also an active immunity which develops several days after the first injection.

GIFFORD, Chicago.

HEREDITY OF KERATOCONUS. G. ABELSDORFF, Arch. f. Augenh. **103**:293 (June) 1930.

The author traced the family histories of a few patients with keratoconus, and found that they had familial keratoconus. Two cousins of another patient were affected with the same disease. In one case both mother and daughter had keratoconus of both eyes. In another case an uncle and his two daughters suffered from the same disease.

In none of the cases could the author find Fleisher's ring. All of his patients were young, between the ages of 15 and 25 years. The Zeiss contact lenses were tried by all of the patients, but only one could wear them for a long time.

The author gives an interesting point. All of his patients were living in the capitol of Colombia, Bagota, which is located 2,600 meters above the sea level, where keratoconus is a rather common disease.

SITCHEVSKA, New York.

RETURNS CONCERNING ONE HUNDRED AND SEVENTY-TWO CASES OF PARENCHYMATOUS KERATITIS. LAZARESCU-POPESCU, Rev. med.-chir., Jassy **40**:41, 1929.

The author presents a statistical study referring to 172 cases of parenchymatous keratitis among 22,000 outpatients and 5,255 inpatients with diseases of the eye. Of the cases, 4.07 per cent were found to occur at from 1 to 5 years of age, 76.74 per cent from 6 to 20 years and 19.19 per cent from 21 to 55 years; 52.9 per cent of the patients were females. Heredosyphilis was present in 74.72 per cent of the cases, and acquired syphilis in 8.14 per cent. Often parenchymatous keratitis is the unique manifestation of heredosyphilis. Hutchinson's triad was found in 3.4 per cent of the cases. Dystrophy of the teeth could be evidenced in 44.76 per cent, deformities of the bones in 30.23 per cent and a positive Wassermann reaction in 80.34 per cent of the cases.

BLATT, Tagu-Mures, Roumania.

TWO CASES OF PERSISTENT PUPILLARY MEMBRANE. D. LAZARESCU, Rev. med.-chir., Jassy **40**:136, 1929.

The pupillary membrane appears in the second month of intra-uterine life and disappears in the fourth or fifth month. In rare cases—as in both cases of the author—it may persist for life. In the ophthalmologic clinic of Jassy under direction of Prof. Dr. Puscariu, only 2 cases of persistent pupillary membrane were found among 22,000 patients. The first occurred in a boy, aged 14, and the second in a student, aged 33, who gave a positive Wassermann reaction. Then

follows the description of the various types which the pupillary membrane can present, among others adhesions to the lens, cornea or iris. Excellent slit-lamp illustrations demonstrate the close and instructive observations.

BLATT, Tagu-Mures, Roumania.

LETHAL SEPTICEMIA DUE TO SEVERE STREPTOCOCCAL CONJUNCTIVITIS. E. LAZARESCU, Rev. med.-chir., Jassy **40**:412, 1929.

A severe case of pseudomembranous conjunctivitis in a child, aged 2 years, is dpescribed. Streptococci and also a few pneumococci were found in the secretion. The further clinical course showed ulceration of the cornea and panophthalmia refractory to any therapy. There was a rise in temperature to 39 C. (102.2 F.). The septicemia resulted in death at the end of a month.

BLATT, Tagu-Mures, Roumania.

Diseases of the Ear, Nose and Throat

NASOPHARYNGEAL ABSCESS: A REPORT OF ONE HUNDRED AND FIFTY-FIVE CASES. SIDNEY RANKAUER, Ann. Otol., Rhin. & Laryng. **39**:481 (June) 1930.

Abscess of the nasopharynx occurs much more frequently than it is generally believed. In 1885, Tornwaldt of Danzig reported a series of clinical observations in which he declared he had seen numerous cases of abscess formation in the region of the recessus medius. These abscesses varied in size from 1 or 2 mm. to several centimeters, and the contents varied from serum or clear mucus to creamy pus. Because these abscesses are situated in the place where the pharyngeal bursa originates, Tornwaldt concluded that these cases were all those of a pharyngeal bursitis. A careful study by the author of the clinical reports of Tornwaldt's cases has convinced him that the cases which he saw were identical with those on which this report is based, but that they are the result not of an inflammation of the pharyngeal bursa, but of an inflammation of the recessus medius of the adenoid. Two thirds of the 155 cases occurred between the twentieth and fortieth years of life, which is the period immediately following the involution of the adenoid mass. Only 11 of the 155 patients had been operated on for the removal of adenoids. Various crypts, which will admit a probe to a distance of 0.5 cm., are frequently found in the mucous membrane of the nasopharynx, being almost invariably located in the median line at the site of the recessus medius. With one or two exceptions, all of the author's cases occurred in the median line.

The local diagnosis of the condition depends on the use of the direct nasopharyngeal speculum. Indirect examination with the pharyngeal mirror is not satisfactory. The mucous membrane surface of the region must be entirely freed from any mucus. An abscess is characterized by the presence of a swelling in the region of the recessus medius, but the swelling may not manifest itself as a rounded protuberance but merely as an elevation of the concavity of the vault of the nasopharynx. It may be red, smooth and glistening, or it may present a dull, gray appearance, resembling polypoid tissue. The symptoms are varied and include indefinite headache, pain in the back of the neck, tinnitus with sensation of fulness in the ear and various types of nervous symptoms. The treatment is carried out through the direct nasopharyngoscope speculum. The region is cocainized and the abscess punctured with a probe. The probe is then moved up and down, converting the puncture wound into a slit. A 20 per cent solution of silver nitrate is then applied with an applicator. This procedure is usually sufficient to eliminate the disease, but in some instances it is necessary to remove the remaining lymphoid tissue.

SNAPP, Grand Rapids, Mich.

STUDY OF THE COMPLICATIONS THAT MAY FOLLOW MYRINGOTOMY. J. L. MYERS, Ann. Otol., Rhin. & Laryng. **39**:807 (Sept.) 1930.

The otologist usually considers myringotomy one of the simplest procedures in his practice, but Myers points out some of the serious complications that may follow this operation, and urges a more serious study and consideration of the technic employed. Among the injuries that may be produced in a myringotomy are: the severing of the chorda tympani nerve; the puncturing of the round window; the severing of the stapedius muscle; the dislocation of the stapes in the oval window; injury to the jugular bulb or carotid artery, with severe hemorrhage, and damage to the epithelium of the mucous membrane over the promontory, thus opening an avenue for infection. To avoid any of these complications, one should be familiar with the anatomic landmarks of the tympanic membrane and should know the sites that may be the source of complication. The best illumination of the operative field must be secured, and a sharp pointed knife with a sharp blade should be used. Care should be used not to strike the inner wall of the tympanum. The author prefers a general anesthetic in all cases as this gives the surgeon a chance to work with caution and deliberation and thus avoid injury to any part of the middle ear.

SNAPP, Grand Rapids, Mich.

MIDDLE EAR AND MASTOID INFECTION IN THE INFANT AS A FOCUS OF SYSTEMATIC DISEASE. G. M. COATES, Arch. Pediat. **47**:275 (May) 1930.

Coates calls attention to the fact that a certain type of gastro-intestinal disorder may be accompanied by, and is probably caused by, infection of the middle ear and mastoid. He stresses the importance of otologic examination, and feels that conservatism should be the rule in the management of such cases unless definite surgical indications are observed. In certain cases a radical operation may be performed on slight surgical indications when other methods have failed.

WADDELL, University, Va.

THE INCIDENCE OF BACTERIA IN FOUR HUNDRED TONSIL CULTURES. HERBERT MARSHALL COBE, J. Infect. Dis. **46**:298, 1930.

In 400 tonsillar cultures, staphylococci are the predominating organism. The streptococci follow the pneumococci in predominance, with the hemolytic streptococci the predominant members of the group. Three per cent of the nonhemolytic streptococci recovered are classed as *Streptococcus cardio-arthritidis*.

There appears to be a definite relationship between the type of organism recovered from tonsillar cultures and the age of the patient, streptococci being more common in younger patients (under 11 years of age).

There is a definite seasonal difference in the organisms recovered from tonsillar cultures: *B. influensae*, *B. mucosus-capsulatus* and the diphtheroids all being more prevalent in the spring and *Micrococcus catarrhalis* in the fall.

AUTHOR'S SUMMARY.

COMPLETE TONSILLECTOMY BY THE SLUDER METHOD. G. PORTMANN, Presse méd. **38**:997 (July 23) 1930.

Portmann considers the Sluder method by far the most desirable one for removing tonsils. He describes it in detail, and includes six excellent drawings of the technic.

BIEKER, St. Petersburg, Fla.

THREE CASES OF OSTEOMYELITIS OF THE BONES OF THE SKULL FOLLOWING AN INFLAMMATORY PROCESS IN THE NASAL SEPTUM. C. E. BENJAMINS, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **126**:133 (July) 1930.

One of Benjamins' cases was observed in a girl, aged 12. The disease started with a nasal cold. The patient died about three weeks later. On necropsy, a

suppurative osteomyelitis of the cranial vault proved to be connected with a bilateral abscess of the nasal septum. The sinuses of the dura mater and the paranasal sinuses remained intact. A secondary extradural and intradural accumulation of pus was present. In the second case, a man, aged 23, underwent a resection of the nasal septum. About fourteen days later, a circumscribed swelling developed in the middle of the forehead, over the right eye. Pus was found in the right half of the nose. The paranasal sinuses appeared intact. The clinical features suggested the diagnosis of osteomyelitis of the bones of the skull. It was confirmed on incision and on examination with a sound. At operation, an erosion of the outer table and extradural abscess in the area of the inner table were found. The third case was observed in a man, aged 21. The patient was admitted to the hospital on account of a painful swelling of the forehead, both eyelids and root of the nose. An abscess was present on both sides of the nasal septum. Incision of the abscess and drainage brought about gradual disappearance of the disease. In none of the cases could the spread of infection from the nasal septum occur by the way of the sinus sagittalis superior or the frontal sinus. Metastasis was also excluded. The author's explanation is that the direct vascular connection between the upper part of the septum and the frontal bone existing in the newly born may sometimes persist in adults. This may be the route by which the infection spread in the cases reported.

[ARCH. OTOLARYNG.]

THE TREATMENT OF SUPPURATIVE ADENITIS IN CHILDHOOD WITH SMALL DOSES OF ROENTGEN RAYS. A. VIETHEN, München. med. Wchnschr. **77**:935 (May 30) 1930.

Viethen discusses the treatment for nontuberculous cervical adenitis secondary to infection of the nasopharynx. If there is no improvement following the use of various forms of counterirritation he advises small doses of roentgen rays. When roentgen treatment is given before suppuration has begun, the adenitis recedes after one exposure in most cases. In some instances a second treatment five or six days later is necessary, and occasionally a third after an interval of ten days. If an abscess has formed, exposure to the roentgen rays helps to wall off the pus. If surgical intervention becomes necessary, it is less extensive in the treated patients.

BRAHDY, Mount Vernon, N. Y.

MASTOIDISMUS AND LATENT MASTOIDITIS. GUSTAV ALEXANDER, Wien. klin. Wchnschr. **43**:577 (May 8) 1930.

In an excellent critical review of mastoid conditions in infants and children, Alexander points out that the terms mastoidismus and latent mastoiditis have been confused and misused by many recent writers on this subject. He gives a number of case reports and reviews the anatomy of the middle ear and mastoid in infants and children.

Unlike many recent American writers, he doubts the possibility of any relationship between so-called latent mastoiditis and diarrhea in infants.

A. F. ABT, Chicago.

Miscellaneous

THE METHOD OF IDENTIFYING NEW-BORN INFANTS AT THE BOSTON LYING-IN HOSPITAL. FREDERICK C. IRVING, Am. J. Obst. & Gynec. **20**:105 (July) 1930.

The Boston Lying-In Hospital has adopted the use of army aluminum identification disks for identification of its new-born infants.

These disks are stamped in pairs with serial numbers. At the time of delivery the mother's name is stamped on the reverse side of the tag. The disks are threaded with a piece of waxed fish line which is passed through a perforated

leaden shot. They are then placed in the delivery kit by the nurse in charge of that particular delivery. After the cord is cut, the accoucheur places one tag around the infant's neck and the other on the mother's wrist, sealing them by crushing the shot with a pair of pliers. The tag numbers are then entered at the top of the delivery sheet. The tags are not removed until the mother and bady are ready to leave the hospital.

ALLEN, Chicago.

SUMMARY OF PROVISIONAL BIRTH, DEATH AND INFANT MORTALITY FIGURES IN THE BIRTH REGISTRATION AREA: 1929. Department of Commerce, Division of Vital Statistics, 1929.

The infant mortality rate for 1929 was 1.5 lower than that for 1928, the rates being 67.3 and 68.8, respectively. The highest was 133.3 (Arizona) and the lowest 47.9 (Oregon).

SANFORD, Chicago.

A GENERAL REVIEW OF MONGOLIAN IDIOCY, WITH A STUDY OF CASES AT THE ELWYN TRAINING SCHOOL. E. A. WHITNEY, M. McD. SHICK, E. BEDROSSIAN and S. P. WHITNEY, M. J. & Rec. **132**:80 (July 16) 1930.

The authors present a detailed study of forty cases together with a review of the literature on mongolian idiocy. They came to the following conclusions: 1. The etiology is obscure. 2. There is a wide variety of physical characteristics. 3. The Mongol is capable of only slight mental development. 4. The diagnosis should be made in infancy. 5. The prognosis is poor from any angle.

WILLIAMSON, New Orleans.

CONGENITAL DIAPHRAGMATIC HERNIA. G. D. F. MCFADDEN, Brit. M. J. **2**: 45 (July 13) 1929.

A case of congenital diaphragmatic hernia is reported in a boy aged 4 years, who had previously had no symptoms. The hernia was of the type most commonly found. It was situated on the left side at the point where the two embryonic migratory muscle elements meet, that is, those fibers developed from the ventral longitudinal muscle sheet and those from the subvertebral muscle mass. There was no peritoneal sac. The left lung was collapsed into the apex of the left pleural cavity. The stomach was normal and in its usual position, but all the small intestine from the duodenum to the cecum, two thirds of the colon and a large part of the omentum were in the pleural cavity.

The symptoms were largely those of intestinal obstruction. However, the chest showed diminished resonance over the base of the left lung and the heart was slightly displaced to the right. There were no breath sounds to be heard over the dull area, but occasionally there was a sound suggestive of an intestinal gurgle. There was no cyanosis or dyspnea.

An oblique incision was made from the ninth intercostal space downward and forward to the umbilicus. The upper part of the incision passed through all the musculature and the peritoneum. In the lower part the anterior and posterior leaves of the rectus sheath were incised and the muscle pulled medially. The incision was continued through the tenth intercostal space so as to pass through the opening in the diaphram. This incision made the reduction easy and there was little shock. The lung reexpanded without positive intratracheal pressure, and in spite of the irritation to that half of the diaphragm caused by surgical intervention.

HUDSON, Chicago.

GASTROMEGALY FROM CONGENITAL ILEUS SHOWING SPONTANEOUS IMPROVEMENT. REGINALD MILLER, Proc. Roy. Soc. Med. **23**:1106 (June) 1930.

A child, aged 6½ years, had suffered from lack of appetite since birth; later there was refusal to take food. Occasionally vomiting was present with diar-

rhea. At the age of 5, roentgen examination showed a large stomach which hid the pylorus and duodenal cap. The child was given a dry diet. In four months there was improvement, but gastric peristalsis was observed. A year later, vomiting had ceased and the appetite was better, but the patient was never hungry; peristalsis was still visible.

WILLIAMSON, New Orleans.

FOREIGN BODIES IN THE SUBDIAPHRAGMATIC DIGESTIVE TRACT IN CHILDREN. M. H. MAVET, Bull. et mém. Soc. de Chir. de Paris **22**:429 (June 6) 1930.

Two cases are presented as an argument against ill advised operative intervention. When there are no symptoms of abdominal distress, one may well postpone operation, watching carefully and checking frequently by roentgenograms. An open safety-pin may cause no disturbance, even in a newly born infant.

BIEKER, St. Petersburg, Fla.

VACCINATION AGAINST TUBERCULOSIS BY THE METHOD OF CALMETTE. PROKOPOWICZ-WIERZBOWSKA, Rev. franç. de pédiat. **6**:191, 1930.

Since 1926, 3,640 infants have been vaccinated with BCG at Warsaw; 920 of these were followed up, and the author's conclusions are based on this group. No harmful effects were observed. Among the infants whose environment was good, there were 9 deaths, but none of these showed tuberculous lesions at autopsy. A positive Pirquet reaction was obtained in 23 per cent, but the reaction was feeble compared with that obtained in 64 per cent of the group whose environment was known to be tuberculous. The latter group numbered 131; 38 were in permanent contact with the source of contamination; 10 showed clinical tuberculosis and 6 died of tuberculosis. This seems to be a high morbidity and mortality rate, and it is difficult to estimate the value of BCG vaccination. Calmette insists on the necessity of isolating the infants receiving BCG from the source of contagion at least for the first 4 weeks of extra-uterine life. The author points out that this isolation was not carried out in most of the cases studied.

LESLIE, Evanston, Ill.

A METHOD OF PREVENTION AND CURE OF CHRONIC ACQUIRED HYDROCEPHALUS BY ROENTGEN THERAPY. C. FRANCIONI, Scritti medici dedicati a Carlo Comba, ediz., Riv. di clin. pediat., 1929, p. 1.

A boy, aged 5 years, had been sick for about three months with severe headaches and vomiting; he had loss of appetite and was peevish. Physical examination showed a tympanitic percussion note over the skull, enlarged pupils which reacted to light, beginning choked disks, a stiff neck, a suggestive Kernig sign, tache cérébrale, and a slow pulse rate (57). The Wassermann and tuberculin tests were negative. The spinal fluid was under increased pressure (800 mm.), but was normal chemically, and cytologically contained no bacteria. Persistence of the symptoms led to the use of roentgen therapy. The rays were applied on four fields: one frontal, two parietal and one occipital, each 6 by 8 cm. The focal distance was 23 cm., and the spark 31 cm. The filters were: zinc, 0.5 mm., and aluminum, 3 mm. In each field the superficial dose was 900 R., and the deep, about 800 R.

The child reacted well to the treatment; within a few days he showed rapid improvement, and after three months seemed essentially normal.

In another case the author was able to relieve, temporarily, hydrocephalus in a child with obstruction of the aqueduct of Sylvius. The roentgen rays probably act on the vessels of the brain, inhibiting the secretory mechanism of the choroid plexus; there may be some action also on the neurovegetative centers of the diencephalon and even on the hypophysis. It is the author's opinion that the method offers considerable relief in an otherwise rather hopeless field.

Roentgen treatment of the brain has been the subject of considerable study during the past four years. The author gives a review of the literature.

HIGGINS, Boston.

A CASE OF POISONING FROM SHOE DYE IN AN INFANT. P. FORNARA, Scritti medici dedicati a Carlo Comba, ediz., Riv. di clin. pediat., 1929, p. 22.

The author was called in consultation to see an infant, aged 6 months, who had become extremely cyanotic during the preceding hour. The infant otherwise seemed normal symptomatically and on physical examination. Recalling references to this condition in the American literature, the author questioned the mother and learned that she had dyed the infant's shoes black on the preceding evening. The dye had been obtained from a nearby shoemaker and was found to contain aniline on chemical analysis. The infant seemed normal the next day, following treatment with hypodermoclysis and oxygen.

HIGGINS, Boston.

STATISTICAL STUDY ON THE WELFARE OF INFANTS CARED FOR IN A FAMILY. K. MOSSE and H. FEILCHENFELD, Scritti medici dedicati a Carlo Comba, ediz., Riv. di clin. pediat., 1929, p. 51.

These authors assembled data on 532 infants who had been brought every two weeks during the first year of life to a well baby (prophylactic) clinic in Berlin. The object of the study was to obtain statistical information as to the welfare of children cared for in a family in contradistinction to those in an orphanage.

The infants nursed for an average of three or four months. While artificially fed, 323 of the 532 infants, showed digestive disturbances, i. e., poor stools, not definitely parenteral in type, and 209 had no upsets, 166 one upset, 54 two upsets and 13 three or more upsets.

The 532 children had 951 infections, 85 per cent of them respiratory. Thus each child had an average of 1.8 infections per year or 1 infection per 200 days. The infectious index (i. e., the number of infections per hundred days) was 0.5; 95 of the children had no infections, 160 had one infection, 126 had two infections and 151 three or more infections. In four orphanages cited for comparison, the infectious index was 1.44, 1.40, 1.64 and 0.46, respectively.

Of 508 of the children, 407 were able to walk at 1 year of age; 75 per cent showed rickets. At 1 year of age, 57 of the children weighed less than 8 Kg., 120 between 8 and 9 Kg. and 353 more than 9 Kg.

The authors feel that infants living in homes usually thrive better than those in institutions.

HIGGINS, Boston.

INTOXICATION WITH SALICYLIC ACID POISONING [illegible] A CHILD. B. DELGADO CORREA and F. NICOLA REYES, Arch. de pediat. d. Uruguay 1:255 (May) 1930.

A girl, aged 13 years, presented symptoms of intoxication almost at the inception of treatment with salicylic acid and seemed to have a marked intolerance for it.

A total of 10 Gm. of sodium salicylate was given by mouth in a twenty-four hour period, and two intravenous injections of 1 Gm. each in a 10 per cent solution of dextrose were made. The most pronounced effects were epistaxis, marked tremors, delirium and bradycardia. The bradycardia was undoubtedly due to the effect of the salicylic acid; this confirms the opinion expressed by the eminent South American clinician, Louis Morquio, that bradycardia in the rheumatic child is due not to the disease but to the therapeutic use of salicylic acid.

While it is desirable to give salicylic acid in the treatment for rheumatism, the authors warn that the intolerance and idiosyncrasy of the individual must be considered and that one must be careful in the matter of dosage.

SCHLUTZ, Chicago.

PSEUDO-HERMAPHRODISM WITH GENITORENAL SYNDROME; TUMOR OF THE RIGHT SUPRARENAL CAPSULE. J. M. ESTAPE and D. DELGADO CORREA, Arch. de pediat. d. Uruguay **1**:362 (July) 1930.

The authors report a case of hermaphrodism in a child, aged 3 years. Growth and development were excessive for this age. The mass growth was especially pronounced, and the child had the appearance and stature of a child, aged 10 years. The parents were psychopathic, and there was alcoholism on both sides. There was marked genital hypertrophy and sexual precocity. The case terminated fatally. At autopsy a tumor of the right suprarenal gland was found. It proved to be a malignant sarcomatoid epithelioma.

SCHLUTZ, Chicago.

ANAPHYLAXIS FOLLOWING REPEATED TUBERCULIN TESTS. FRANZ HEFNER, Monatschr. f. Kinderh. **47**:315, 1930.

After two Pirquet tests the writer gave an intracutaneous test with 0.1 mg. of old tuberculin. A severe anaphylaxis followed by swelling of the cervical lymph nodes, liver and spleen and by collapse. Recovery was not complete for ten days.

GERSTLEY, Chicago.

THE USE OF ANATOXIN. DORA HARTMANN-KARPLUS, Monatschr. f. Kinderh. **47**:319, 1930.

The author gives an excellent review of the literature describing the experimental development of diphtheria toxoid and its practical use. Reports from many lands are enthusiastic. The toxoid apparently is superior to toxinantitoxin. The only disadvantage is that the reaction from it may be a little more severe. Efforts have been made to give it by cutaneous inoculation, but the results so far show that immunity develops in only 60 per cent of patients so treated whereas it occurs in 90 per cent of patients treated by inoculation.

GERSTLEY, Chicago.

FORM AND STRENGTH OF BODY IN CHILDREN AND ADOLESCENTS. E. SCHLESINGER, Ztschr. f. Kinderh. **49**:159, 1930.

The judgment of the constitutional types by inspection is to be considered more comprehensive and significant than the anthropometric determination. A testing of the subjective judgment by objective measurements makes the determination more certain. In children more than in adults, emphasis is to be laid on the inspection of the size as a whole, the kind of development, the condition of the musculature, that is, the posture, and the shape of the chest. Retarded development may make decision difficult. The ratio of length to breadth and to depth is well given in Rohrer's index $\frac{\text{weight} \times 100}{\text{length}^3}$. The practical meaning of this index of stature is increased by its age constancy from 6 to 17 years, and by the large uniform intervals in the average values in the different types from 9 years up. The index for leptosomes is 1.1. These children are of the respiratory type, large or of average size, slender, with long arms and legs, moderate to good development of musculature and bone, a thin or moderate layer of fat and an average width of the chest. The index for eurysomes is from 1.3 to 1.4. This is the digestive type, of average to below average size, overweight, with short thick limbs, strong musculature and compact bones, a thick layer of fat, and a broad chest. The index for the musculature type is 1.2. This is the average form that stands between the other two.

The usefulness of the proportional circumference of the chest is diminished in spite of the wide intervals in the average values, on account of the age inconstancy and transition forms. The somatoscope of Drescher gives the types of constitution in a clear, graphic, easily transcribable way.

EMERSON, Boston.

INDIVIDUAL REACTIONAL DIVERGENCES IN CHILDREN AFTER VACCINATION WITH B C G VIRUS. ARVID WALLGREN, Acta pædiat. **10**:76 (Aug. 18) 1930.

When infants are vaccinated parenterally with B. C. G. vaccine and subsequently, while under isolation, are tested once a week with the intracutaneous injection of 1 mg. of tuberculin, the first appearance of tuberculin allergy (and presumably of the development of resistance to tuberculosis) follows after an inconstant interval in individual cases. The preallergic period following vaccination of this kind is from four to eight weeks in most cases, but in the entire series of forty-nine cases studied, the extremes were three weeks and more than twenty-one weeks. These differences in the time required for the development of allergy occur in spite of rigid control of the virulence of the vaccine used. Age does not appear to be an important factor, although there is a tendency for infants of relatively low weight for their age to react more slowly. The great variability of the preallergic period cannot be explained, however, on the latter basis and must be attributed to individual constitutional factors as yet imperfectly understood.

The importance of isolation of the vaccinated infant from tuberculous contact during the preallergic period is clearly demonstrated. In a series of fifty-three newly born infants vaccinated perorally by Lemaire, Imbert and Dreyfus and isolated for an inadequate period without control of allergy by the tuberculin test, twenty-seven of the patients were subsequently exposed to a tuberculous environment; and of the latter twenty-two showed clinical or roentgenographic evidence of tuberculosis on reexamination, 1 of them dying of tuberculous meningitis. In Wallgren's series of thirty-six patients exposed to a tuberculous environment for from one to twenty-one months after the development of allergy, only 2 showed roentgenographic evidence suggesting tuberculosis of the bronchial glands and none gave clinical evidence of involvement.

McINTOSH, New York.

LYMPHOCYTOSIS IN CHILDREN. J. HAVERSCHMIDT, Nederl. tijdschr. v. geneesk. **74**:3082 (June 21) 1930.

The number of leukocytes in the young child shows physiologic variation. Except during the first days of life the lymphocytes predominate in the blood of the child. The most commonly accepted explanation of this fact is an increased function of the lymphatic tissue. The number of lymphocytes in healthy children is often high, a fact not easily explained. The circumstances under which this "lymphatic reaction" is found are discussed. The lymphatic reactions in children may arise under circumstances that do not cause such a condition in adults. It is accepted that sometimes the abnormal increase in the number of lymphocytes is constitutional. Other symptoms of exudative lymphatic diathesis may also be present. The author gives some examples of this type. Also infections that produce a polymorphonuclear leukocytosis in adults may sometimes give rise to lymphatic reactions in children. In such cases, though the disease is accompanied by high temperatures, the neutrophilia is small, but the deviation to the left nearly fails or the leukocytosis is weak. The cause of these conditions is unknown. Other diseases in children are nearly always accompanied by a lymphocytosis (e. g., in whooping cough and in rubeola, together with an increase of plasma cells). Recently a number of cases of angina were reported in which there was a characteristic lymphocytosis that remained long after the angina had cleared up. The same condition may occur in other diseases. In these cases also it is still questionable whether one may speak of a constitutional factor.

The lymphocytosis in anemic conditions in young children is discussed. The author observed cases of congenital syphilis showing 89 and 86 per cent lymphocytes. In premature children with a low birth weight the lymphocytosis may appear soon after birth and may reach a high percentage.

The author discusses the difficulties that arise in differentiating a lymphatic reaction from acute lymphatic leukemia, and the latter from sepsis.

VAN CREVELD, Amsterdam, Holland.

THE BLOOD AFTER IRRADIATION WITH ULTRAVIOLET LIGHT. W. J. H. BUNGERBERG DE JONG, Nederl. tijdschr. v. geneesk. **74**:3092 (June 21) 1930.

In the clinical judgment of the effect of the irradiation with sunlight and artificial light, particular value has been attached to the pigmentation that occurs. Little is known about the influence exerted by this pigmentation and about the changes taking place in the blood after irradiation with ultraviolet light. The author studied this influence in guinea-pigs. He found that the differential white blood cell picture in these animals varied too much to reveal the changes caused by irradiation. The total number of white blood cells was less variable. After long-continued irradiation with ultraviolet light, an increase in the number of white blood cells was observed in guinea-pigs. In the blood of the animals irradiated for a long time, the number of polychromatophyl cells increased, whereas the number of vitally stained cells remained the same.

The resistance of the red blood corpuscles to anisotonic salt solutions increased after the irradiation, a symptom that continued to exist long after irradiation had been stopped. The supposition of Von Rhoden (1920), that the changes in resistance after irradiation in human subjects would be dependent on the fact that young red blood corpuscles would come into circulation, could not be confirmed with vital staining and polychromatophilia.

VAN CREVELD, Amsterdam, Holland.

A SIMPLE OXYDASE REACTION FOR BLOOD FILMS. R. ROELOFS, Nederl. tijdschr. v. geneesk. **74**:3524 (July 12) 1930.

Several attempts have been made to modify the oxydase reaction of Winkler-Schultze, used in the clinic for the differentiation of myeloid and lymphatic elements in the blood. The results obtained with this method, however, have been unsatisfactory. The author obtained good results with the dopa reaction, described in 1916 by Bloch but until now apparently not introduced into the clinical work. Roelofs used a dopa solution of about 0.1 per cent, prepared by dissolving a knifepoint of the substance in 10 cc. of distilled water to which 1 or 2 drops of tenth-normal sodium hydroxide have been added. This solution may be used for several days after its preparation. With this test the leukocytes show a dark brown to black substance in their protoplasm, the dopa melanin. The large monocytes give a weakly positive reaction. The myeloid cells all give a strongly positive reaction; sometimes, however, the myeloblasts do not give an oxydase reaction. It is the author's experience, however, that in all cases in which the cells give an oxydase reaction, the dopa test is preferable to indophenol blue synthesis and even to the so-called peroxydase methods.

VAN CREVELD, Amsterdam, Holland.

THE IMPORTANCE OF PERIODIC HEIGHT-WEIGHT DETERMINATIONS IN SCHOOL CHILDREN. P. M. HOLST, Norsk mag. f. laegevidensk. **91**:661 (June) 1930.

Periodic height-weight determinations, which take rather a broad place in all examinations of Norwegian school children, at the expense of a routine physical examination, do not give a satisfactory expression of the condition of the child. The weight of a person is determined by constitutional factors and does not always change even when severe disease is present in the body. If the work of the school physician mainly consists in controlling the height-weight relation in children, the author believes that many diseases may be overlooked. As long as the weight is good the child is not sent to the physician, and thus many diseases may be overlooked in children with some fat depot.

TOVERUD, Oslo, Norway.

Society Transactions

PHILADELPHIA PEDIATRIC SOCIETY, NEW ENGLAND PEDIATRIC SOCIETY AND NEW YORK ACADEMY OF MEDICINE, SECTION OF PEDIATRICS

JOHN CAFFEY, M.D., *Secretary*

Combined Meeting, New York, Oct. 11, 1930

HUGH CHAPLIN, M.D., *Chairman*

TWO CASES OF MEDIASTINAL TUMORS IN INFANTS. DR. MARTHA WOLLSTEIN, New York.

Mediastinal tumors in young children are not common. At the Babies' Hospital, Dr. Wollstein had the unusual experience to see two within a period of six months. The first case, that of solid teratoma of the mediastinum in a boy 6 months old, will be reported in detail in the AMERICAN JOURNAL OF DISEASES OF CHILDREN.

The second case was that of a white boy, aged 16 months, who weighed 6½ pounds (2,954.35 Gm.) at birth and was apparently normal. The family history was irrelevant. At the age of 1 year he weighed 18 pounds (8,164.8 Gm.), and at 16 months, 22 pounds (9,979.2 Gm.), which is somewhat underweight. He walked at 14 months, and never was acutely ill. The present illness had a sudden onset two weeks before admission, when the child became slightly hoarse, without fever, anorexia or dyspnea. An x-ray picture showed the presence of fluid in the left side of the chest, and 60 cc. of straw-colored fluid was withdrawn. This proved to be sterile, and in the next five days two other taps removed similar fluid which was also sterile. A tuberculin test gave negative results. On admission to the Babies' Hospital, the patient was well developed but poorly nourished; he was pale, with a mildly cyanotic tint to the brow and scalp. He was breathing rapidly with an excretory grunt and was irritable and restless. There was neither hoarseness nor aphonia. The left side of the chest bulged.

On physical examination, the resonance over the whole anterior part of the chest was impaired, and there was flatness posteriorly. Over the right side the note was hyperresonant, with tubular breathing on the left. The heart was 4 cm. from the sternal line, pushed to the right. The sounds were rapid, and were loudest at the left of the sternum, without murmurs. The abdomen was sunken, without tenderness or masses. The fingers were not clubbed or cyanosed. The impression was of a massive pleural effusion with compression of the left lung, and the question of tuberculosis, pyogenic infection and neoplasm was considered. The following day 250 cc. of clear, thin fluid was aspirated from the left side of the chest which again proved to be sterile. The temperature was normal. Two days after admission he seemed better, but later in the day he suddenly became dyspneic, cyanotic and restless. Neither sedatives nor the oxygen tent were of use, and he died within two hours. An x-ray film taken on the day of death showed the presence of a large mediastinal tumor and a pneumothorax on the left side. Examination of the blood showed: 74 per cent hemoglobin, 5,800,000 red cells, 14,700 white cells, with 48 per cent polymorphonuclears and 52 per cent lymphocytes. The urine contained 2 plus albumin, but was not otherwise abnormal. The tuberculin test gave negative results.

Autopsy showed a thymic neoplasm with metastases into the left lung, pleura, pericardium, liver, kidneys and diaphragm; atelectasis, and fatty liver. On removal of the sternum, the right lung was seen to fill its pleural cavity, while

the left lay behind a large globular mass which was in the midline and extended to the right, almost filling the left pleural cavity. This mass was white, fairly firm, 9 cm. transversely and 10 cm. vertically. At its upper border the two small cervical lobes of the thymus gland were apparent, while the rest of the thymus merged into the tumor, which was adherent to the pericardium and to the apex of the left lung, invading both. The pericardial sac was small and its right border extended just beyond and below the right border of the tumor. The trachea was pushed to the right. The left side of the diaphragm had to be removed with the mass, and the left pleura was covered with tumor nodules from 2 to 15 mm. in diameter. Below the diaphragm there were metastases in the kidneys and the liver. On section, the neoplasm was soft, white and not vascular. The right lung was aerated and moderately edematous. The left lung was leathery, not aerated and much smaller than normal. In the apex there was a neoplastic nodule 1.5 cm. long and 0.5 cm. deep. At the base above the diaphragm there were three small nodules in the substance of the lung. The thyroid was normal. In the liver there was a pinhead-sized metastasis in the right lobe surrounded by a small area of hemorrhage. The kidneys showed several metastases in the cortex.

On microscopic examination, the tumor was found to be a lymphosarcoma. Hassall's bodies were present in some parts of it and in the compressed upper lobe of the thymus. Throughout the other portions of the tumor they were very small, few in number and embryonal. The metastases in the pleura, diaphragm, liver, kidney and lung substance showed the same lymphocytic cells as did the primary tumor.

Tumors of the thymus are not common, and they occur less frequently in children than in adults. The clinical history is usually of short duration, from four to nine weeks being the average, and a year in one of Foote's cases being the exception. Death is often sudden, due to pressure; hemorrhage has occurred. The growth is large and lobulated and often infiltrates the pleura and pericardium, but leaves the hilus free. Metastases to all the viscera have been reported, but those below the diaphragm are least common.

A thymic tumor may be : (*a*) carcinomatous, from the epithelial cells of the thymic reticulum. These tumors occur in persons over 35, but Foote described a case in a 2 year old child. (*b*) Lymphosarcomatous, from the mesodermal lymphocytic cells of the thymus. Such tumors are often but not invariably accompanied by a leukemic blood picture. Finally, there is the true (*c*) thymoma or lympho-epithelial tumor from the embryonic thymic rests, reproducing the epithelial reticulum cells, the lymphocytes and the Hassall bodies.

The case reported was malignant, with metastases to the kidneys, pleura, pericardium, lung and liver. The blood picture was normal.

A Case of Eosinophilic Leukemia. Dr. Murray H. Bass, New York.

Dr. Bass presented a young boy. In his case, the interest centered mostly on the history of the observations on the blood. The boy was admitted to Mount Sinai Hospital in November, 1929. He was a Porto Rican, and had arrived in New York a few months previous to admission. He had a rather poor start in life; the family was very poor, and he did not receive much care. He had had whooping cough and measles, and had been under the care of someone who might have had tuberculosis. His mother's first husband was syphilitic; the patient was markedly undernourished and badly fed. He was admitted to the hospital on account of loss of weight, alternate diarrhea and constipation and occasional vomiting. On physical examination, he was found to be underweight, pale and badly cared for. Further examination showed a moderate cough, malnutrition, some general glandular enlargement and coarse râles in the chest. The urine was normal. The blood count made the case unusual. The first examination of the blood showed that which all the rest showed, namely: red cells, 3,500,000; hemoglobin, between 47 and 60 per cent; white cells, from 26,000 to 47,000; differential count: polymorphonuclear neutrophils, 12 per cent; lymphocytes, 12

per cent; monocytes, 3 per cent, and eosinophilic polymorphonuclears, 73 per cent. The eosinophils varied from 32 to 76 per cent. The white blood count was constantly elevated, the lowest being 26,000.

The stools showed no evidence of parasites. There was no history of asthma. Tests of the sensitization to proteins gave negative results; the intradermal test for echinococcus also gave negative results. Chemical analysis of the blood gave normal results. The Wassermann reaction was negative. A roentgenogram of the gastro-intestinal tract showed nothing abnormal.

The roentgenograms of the chest were interesting. They showed a marked mottling of both sides, suggesting miliary infiltration. The Pirquet test gave positive results, which, with the peculiar mottling, made one think of a possible miliary tuberculosis. The eyegrounds were normal. No tuberculids were found. The patient was in the hospital for four or five months, during which time he did not have fever. He gained in weight and did fairly well. It was thought that the case probably belonged to the rare group known as eosinophilic leukemia, and a biopsy from the sternal marrow showed a marked hyperplasia with a preponderance of eosinophilic cells.

At the time of presentation he had been under observation for one year, and during that time his condition had remained about the same, until three days previously, when he began to have a rise in temperature, for which no cause was found. One other interesting feature was the basal metabolic rate. It was studied several times, and each time it was greatly elevated. Once it was plus 32, and at another time, plus 48. Dr. Bass thought that any other cause for eosinophilia could be ruled out. The eosinophilia was too great to attribute to any of the common causes. The ordinary case of asthma, sensitization or infestation with parasites does not show 73 per cent of eosinophils.

In 1925, Dr. Bass reported a similar case, which he was not able to work up as completely, as one of hyperleukocytosis in a girl, aged 6. Since that time a number of cases similar to the one presented have been reported, so that, including the one reported in 1925, the one presented is the eleventh case of this peculiar symptom complex.

Only three cases have been reported in children. The one presented, the one reported in 1925, and one reported by Armand Delille in Paris, who reported it merely as a curiosity, not knowing how to classify it.

These cases are interesting in that they are mostly chronic and may occur with or without fever; most of the patients have enlarged spleens, many of them have enlarged lymph nodes, and they have a persistent increase in the total white cell count and a persistent increase in the number of eosinophils. Moreover, they are interesting in that the eosinophils are not premature cells, but the fully formed, normal adult type of cell.

The autopsies in the other cases, when they were obtained, showed infiltration of the internal organs with eosinophilic cells. It is interesting that several of these cases have been thought tuberculous, because they began with cough. In Armand Delille's case, as described, the x-ray plates were exactly like those in the case presented. He also thought at first that his case was miliary tuberculosis. A case that was described by Harrison was thought to be tuberculous until the peculiar blood count revealed it to be leukemia. Autopsy showed the organs, including the lungs, packed full of eosinophilic cells.

Whether one should call the disease leukemia when it has so little in common with ordinary leukemia is questionable. The hemorrhagic tendency is absent. This has been true of all the cases.

One interesting feature that helps class the illness as leukemia is the enormously increased metabolic rate. Dr. Bass knew of no other disease, except that of the thyroid gland (which the child presented did not have), in which the metabolic rate is plus 48.

These cases resemble each other in the following features: The disease is usually chronic, only one case running an acute course ending in death in three weeks. The spleen is usually considerably enlarged. The disease may or may not be accompanied by fever. The blood shows an increase in the total white

cell count up to 236,000. There is a persistent, unusually large, increase in the number of eosinophil cells. They are mostly of the adult type. A tendency to severe anemia and hemorrhage is absent.

There is one other disease to which the case presented may be related, and that is Hodgkin's disease. There are cases of Hodgkin's disease described with eosinophilia. However, the cases of this particular group that have come to autopsy have not shown anything resembling Hodgkin's disease in the microscopic examination. The patient presented showed no intrathoracic lymph nodes such as one sees in Hodgkin's disease. Dr. Bass thought that, owing to the hyperleukocytosis, the eosinophilia and the increased metabolic rate, he was justified in classifying this unusual condition as eosinophilic leukemia.

A Case of Healed Miliary Tuberculosis. Dr. Charles Hendee Smith, New York.

A boy, aged 6 years and 7 months, born in May, 1924, was presented. His mother had had pleurisy and probably an arrested first stage of tuberculosis. His father had a chronic cough, which had recently been diagnosed as tuberculous. Positive sputum had not been found in either parent. The patient had one brother who gave a negative reaction to the tuberculin test. He had had measles in his second year. At about the age of 2 years he began to fail, and became fatigued easily; some disease of the eye developed, which was diagnosed as tuberculosis. At 2 years and 10 months of age, the eye was enucleated at the Manhattan Eye and Ear Infirmary, and was found to be tuberculous. The patient was seen by Dr. Smith nearly two years later. He was first seen in the Bellevue Observation Clinic in September, 1928, at the age of 4 years, two years after the eye had been enucleated. Roentgen examination showed a condition that was surprising, and which continued to be so. At that time he weighed 28 pounds (12,700.8 Gm.).

The patient had large tonsils, a discharge from the ear and a palpable spleen, but he had no fever or signs in the lungs. The urine was normal. The blood was practically normal. The Wassermann reaction was negative. He had been under observation from September, 1928, intermittently, to the time of presentation.

His family did not cooperate well, and had to be followed up constantly. They would not keep the patient at rest when he needed it, and would not let him go to the hospital when he seemed to need it, although he spent two summers in Seaview Hospital, the hospital for tuberculous patients on Staten Island.

In March, 1930, he weighed 35.14 pounds (15,939.5 Gm.), a gain of 6 pounds (2,727.55 Gm.) in a year and a half. He felt well; there were no signs in the lungs, and he had no fever at any time. At that time he was well nourished and in good condition. At 6 years he was a little underweight, but was not very tall.

That summer he went to Seaview Hospital and was discharged from there two months before presentation; soon after that whooping cough developed. The whooping cough had greatly weakened his general condition. He weighed 34 pounds with his clothes on, as against 35.14 pounds stripped in March, 1930.

The patient could not be presented as having a case of healed miliary tuberculosis, but Dr. Smith thought that the case was worth presenting as one in which the patient had been known to have had a disseminated disease of the lungs for two years, in spite of which he had done well until whooping cough developed.

Dr. Smith saw him first a week before presentation; he had been in bed since, and looked a great deal better than when first seen. He is said not to have had fever. The week before presentation, he had had râles all over the lungs, which is the first time there had been any physical signs.

The day before presentation the lungs were practically clear again; there was the slightest possible change in the breath sounds, which were rather smooth and high pitched over the posterior part of the chest.

Dr. Smith showed the following roentgenograms:

In 1928, when the patient was first seen, a roentgenogram showed a mottling of generalized tuberculosis. There was no way of telling from the plate whether the condition was a miliary, blood-borne dissemination or a dissemination of tuberculous bronchopneumonia through the air passages.

The second slide was even more difficult to interpret. It is possible that the shadow seen was from disseminated tuberculosis borne by the blood stream or by the bronchi. One should remember that a miliary tuberculosis, pure and simple, with single scattered miliary tubercles, may show no shadow. It takes an agglomeration of tubercles, two or three together, to cast even the smallest shadow.

The third slide was taken three or four months after the second and showed that the shadows were getting larger and denser. It looked as if the lungs, by contrast, were clearer between. This slide was taken a year before presentation, when the patient was running around, perfectly well, and showed an increasing density of all mottlings.

The next slide was taken in August, when the patient was in an excellent condition. The middle third of each lung was densely involved, and yet he had no cough, and there was no sputum. The involvement spread from a blood-borne rather than an aerogenic infection. It seemed that the patient could not have as much bronchopneumonic tuberculosis as that without having some cough and some sputum.

The fifth slide was taken on October 2, and showed the same condition. From this x-ray picture it seemed that the whooping cough had weakened his condition, but it was hoped that it had not lighted up any local focus.

Can miliary tuberculosis heal? There is no question about it. Dr. Smith said that he had seen some slides of Dr. Gardner of Saranac of a longshoreman who was killed in a drunken fight. The man had been perfectly well and had been working. One of the lungs was studded with healed miliary tubercles, which were as thick as they could be and were scattered throughout the lung.

Last summer, while in Pirquet's Clinic, Dr. Smith saw three cases of healing miliary tuberculosis, in which there were shadows like those in the case presented; the patients were well. It was said that they saw a large number of patients in the clinic who got well, and who apparently stayed well. That can happen. Whether this would happen with the patient presented, Dr. Smith said he did not know, but he hoped so.

THE DIAGNOSIS OF RHEUMATIC PERICARDIAL EFFUSION. DR. LUCY PORTER SUTTON, New York.

The object of this paper is to call attention to the pulmonary signs associated with moderate and large pericardial effusion. Although Pins described these signs in 1889 as a "new symptom of pericarditis," and Curschmann, in 1907, wrote a classic article demonstrating the anatomic reasons for their occurrence, it has not been generally recognized that the effusion itself is responsible for the production of striking physical signs over the lower part of the chest posteriorly. In 1926, Connor called attention to the work of previous investigators and presented his own views of the clinical and anatomic considerations.

For many years at Bellevue Hospital the pulmonary signs found in children with rheumatic heart disease have been discussed and various diagnoses made, usually compressed lung, pneumonia, pleural effusion or pulmonary infarction. It is now thought that pericardial effusion is the correct interpretation of the signs to be described.

In considering the diagnosis of pericardial effusion, two facts must be kept in mind: 1. Contrary to earlier teaching, the heart does not change its position materially in the presence of effusion. The attachments are so firm and the heart so completely fills the space between the anterior wall of the chest and the spinal column that it is impossible for it to sink downward and backward as was formerly assumed to be the case. Curschmann and others have clearly shown that in the presence of effusion the heart maintains its position in relation to the anterior wall of the chest, except possibly for the apex. 2. An inflamed pericardial sac is distensible far beyond the capacity of a normal pericardium.

Because of the attachments of the great vessels and the fact that the heart lies a little more to the left than to the right side of the chest, the left pouch of the

pericardium becomes more distended with fluid than the right. As it becomes more and more filled, it extends below the hilus of the lung posteriorly, pushing the lung upward and laterally, until the pericardium actually comes in contact with the posterior wall of the chest. Curschmann thought that the lung was pushed medially, but Dr. Sutton agreed with Connor that it must be compressed laterally.

The signs thus produced are dulness to flatness on the left side of the chest, from the angle of the scapula down. Over all or part of this area there is bronchial breathing, usually intense, with bronchophony or egophony. The reason for the bronchial breathing is the direct transmission of the breath sounds from the bronchus, with which the distended pericardium is in contact. Tactile fremitus persists, but may be diminished. Frequently there are fine râles just above this area. Dr. Sutton found, as Connor did, that there is always an area of resonance, sometimes very small, between the posterior dulness and the left border of cardiac dulness. The outline of the area over which these signs are found is distinctive in contrast to that found in pleural effusion. A similar but smaller area is often present on the right side.

In order to demonstrate that these signs are actually produced by the pericardial effusion, Dr. Sutton studied eight cases carefully and proved to her satisfaction that Curschmann's explanation is in the main correct. Every case showed a roentgen shadow characteristic of pericardial effusion; the pulmonary fields, as shown by the x-ray film or by fluoroscopy, were clear, thus excluding pleural fluid, and fluid was easily obtained by thoracentesis in the seventh or eighth space posteriorly.

It is not necessary to go into the other signs of pericardial effusion, but it is interesting to note that the pericardial friction rub was heard in all of the cases, while effusion was known to be present. In some it became less pronounced for a day or two, but it was heard most of the time. The persistence of the rub, therefore, does not exclude the presence of pericardial fluid.

In the second case, in which the tap was made posteriorly, before the position of the lung was definitely ascertained (that is, whether it was pushed laterally, or toward the vertebrae), the needle was inserted more laterally than in any other case, and pneumothorax resulted, with almost complete collapse of the lung. This caused the child no discomfort, and the air was rapidly absorbed. Since then, a site at about the center of the flattest area, usually more toward the spine than the axilla, has been chosen, and in no other case has the lung been pierced. One case came to autopsy nine days after the tap, and there was no evidence on the visceral pleura of puncture by the needle.

In conclusion, signs such as have been described constitute in themselves evidence of the presence of pericardial effusion. If doubt exists, roentgen examination or fluoroscopy will show whether or not pleural effusion is present. The posterior site for tapping the pericardium is perfectly safe, and one is far more certain of reaching the fluid than by the points formerly recommended. Although only one of the cases seemed to require relief because of the size of the effusion, it is possible that removal of some of the fluid may hasten absorption and thus lead to quicker recovery. One certainly need have no hesitation in adopting this procedure either for diagnostic or for therapeutic purposes.

PHENYL-ETHYL-HYDANTOIN TREATMENT OF CHOREA. DR. ROGER H. DENNETT, New York.

Phenyl-ethyl-hydantoin (nirvanol) was introduced abroad in 1916 as a sedative, but it was not until 1919 that Roeder recommended its use in the treatment for chorea. For some reason it was not used in this country until the last year or two, and it was not until June, 1930, when Ray and Cunningham of Rochester, N. Y., published their article in the AMERICAN JOURNAL OF DISEASES OF CHILDREN, that it came into more or less general use here. During the last three months, Dr. Dennett had used the drug in twelve cases, and he apologized for reporting so small a number of cases, as well as for the statement that in

every case the choreiform movements ceased within seventeen days after the beginning of the treatment. A large number of cases could hardly be expected to show such universally good results, nor has enough time elapsed in these cases to show how many relapses there may be, although none has occurred to date. Leaving the permanency of the results out of consideration, Dr. Dennett said that he was convinced that it is the best treatment yet devised for controlling the individual attack.

The treatment is simple and available to all, since it consists only of the administration by mouth of a 5 grain (0.324 Gm.) tablet of phenyl-ethyl-hydantoin two or three times a day. The child is put to bed, kept on a simple diet, and, if under 6 years of age, given a tablet at night and one in the morning, while older children are given three tablets a day until a rash or fever or both are induced by the drug, usually on the seventh or eighth day, when the drug is stopped and no further treatment is given. A certain train of symptoms is produced by the drug, namely, drowsiness, fever, rash, leukopenia, eosinophilia and lymphocytosis. This is called phenyl-ethyl-hydantoin sickness. The drug is unique, since it is the only drug that brings about a definite train of symptoms resembling one of the acute exanthems.

Drowsiness begins on the third day, when the child appears sleepy but rouses for food, urination and defecation. Each day the drowsiness increases until the patient is almost stuporous and can be made to eat only with difficulty. Dr. Dennett said that in the first case they were alarmed by the intense stupor, but subsequent experience proved it to be harmless, and although all of the patients were intensely drowsy, they could be roused to answer a question or to take a small amount of food. On the seventh or eighth day, when the drug is stopped, the drowsiness reaches its maximum point, gradually clearing up in the next four or five days, when the patient again becomes alert and the choreiform movements have disappeared. As the drowsiness begins, there is an exaggeration of the choreiform movements; that is, the chorea seems worse, and a peculiar drawling speech develops. This peculiarity of speech was seen in every case and resembled the speech of an epileptic patient after a severe convulsion.

Fever usually starts on the seventh or eighth day, and its advent is an indication for the withdrawal of the drug. In some of the cases the temperature rose to 104 F., in others from 101 to 102 F., and there were two patients who never had more than a rise to 100 F. The fever lasted four or five days after the drug was stopped and recurred in only one case, probably owing to some other cause.

In every case the rash began on the seventh or eighth day, usually with scattered papules over the back and shoulders. These papules became macules which coalesced and gave an appearance much like measles, gradually spreading to the rest of the trunk and to the extremities. Later, or at some time during the febrile stage, a scarlatiniform rash appeared, usually on the face and sometimes covering the entire body, the intense, bright red, fine rash closely simulating scarlet fever. The soft palate and the throat became injected and in some instances resembled the throat of a patient with scarlet fever. After from four to six days, the rash gradually disappeared, leaving no exfoliation or other evidence of its severity. The use of phenyl-ethyl-hydantoin should always be discontinued at the onset of the rash even if unaccompanied by fever.

Leukopenia occurred in every case, the lowest white count being about 3,000 white cells, and in some instances in which the white count had been 12,000 or 14,000 before treatment, it dropped to 5,000.

Lymphocytosis was coincident with the leukopenia, 66 per cent of lymphocytes being the highest and 40 per cent the lowest.

Eosinophilia was not invariably present, as reported by other authorities, but 8 or 10 per cent of eosinophils were found in some of the cases. There is reason to believe that the stain used in the laboratory at that time did not bring out the eosinophils as definitely as usual, and that this phase of phenyl-ethyl-hydantoin sickness may have been overlooked in some of the cases, since, subsequently, a special request for a count of the eosinophils revealed eosinophilia.

Four of the patients had had previous attacks, one each in two cases, two in one and three in another. At the time of treatment, the attack had lasted three months in three cases, two months in two cases, ten weeks in one case, seven weeks in three cases and six in four weeks in each of the other cases. The twelve cases were of the severer grade of chorea, three patients suffering from such aggravated choreiform movements that the sides of the crib had to be padded in order to prevent possible injury to the patient. The longest duration from the beginning of treatment to the cessation of the choreiform movements was eighteen days, the shortest, eleven days, the average duration being 14.2 days. A brief tabulation of the cases is as follows:

Analysis of Twelve Cases

Case	1	2	3	4	5	6	7	8	9	10	11	12
Number of previous attacks..	0	1	2	0	0	0	0	3	0	1	0	0
Number of weeks' duration before treatment.....	6	10	4	6	7	7	8	7	8	12	12	12
Number of days' duration of treatment	7	8	7	6	9	8	9	9	7	6	7	7
Number of days' duration of rash	7	5	6	7	7	5	4	5	4	4	7	5
Number of days' duration of fever	9	0	6	7	9	0	6	5	6	5	8	7
Number of days from beginning of fever to cessation of choreiform movements..	18	17	15	14	16	12	16	13	11	11	14	13

ACUTE MENINGOCOCCUS BACTEREMIA. DR. STAFFORD MCLEAN, New York.

Dr. McLean presented a series of case reports of acute meningococcus bacteremia in infancy and early childhood. He stressed the practical value of stab puncture of the purpuric areas as an aid to early diagnosis. In twelve of seventeen cases meningococci were demonstrated by this method during life from punctures of the skin. In two of the cases in which meningococci were recovered from the peripheral blood by a puncture of the exanthem, cultures of the blood showed no growth. In one of these two cases cultures of the blood and cerebrospinal fluid were sterile.

Photomicrographs of intracellular and extracellular meningococci obtained from punctures of the eruption on the skin were shown. The question of the relationship between suprarenal hemorrhage and early death in the fulminating cases was discussed on the basis of the discovery of suprarenal hemorrhage in five of the cases that came to autopsy.

THE LEUKOCYTIC REACTION OF TUBERCULOSIS IN INFANCY AND CHILDHOOD: SUPRAVITAL STUDIES. DR. CARL H. SMITH, New York.

The general reaction in various forms of tuberculosis of infancy and childhood was investigated. The results were viewed in the light of the more recent conception; namely, that the peripheral blood reflects the activity of the tuberculous lesion.

The author quoted the work of Cunningham, Sabin, Sugiyama and Kindwall on rabbits, that of Rogers, and Blackfan and Diamond, who used the supravital method in tuberculous infants and children, and that of Medlar.

The present report was based on 382 supravital counts in 91 infants and children, 50 of whom served as a normal group. In analyzing pathologic blood counts, comparison in each case must be made with the blood picture of a normal child of corresponding age. The high lymphocytic percentage of normal children must always be considered, especially since this cell is regarded as evidence of healing and resistance in tuberculosis. It was observed that as the lymphocytes

decreased and the monocytes increased with age, the average normal ratio of monocytes to lymphocytes varied accordingly, from 0.09:1 in infants under a year to 0.25:1 in children over the age of 4 years.

Representative cases were analyzed to illustrate the various types of leukocytic response.

In acute miliary tuberculosis with or without a complicating meningitis, the total white count is elevated, the neutrophilic leukocytes and monocytes are increased, and the lymphocytes are decreased. Stimulated monocytes and epithelioid cells appear in the peripheral blood. While stimulated monocytes are of frequent occurrence in the blood in acute cases, the epithelioid cell was observed much less often than might be expected from experiments on animals. The reason rests, no doubt, on the massive doses of organisms experimentally injected into the rabbit as compared with the smaller dosage in cases in human beings. In acute cases, the eosinophilic leukocytes disappear during the stage of marked activity. Their continued absence bespeaks a poor prognosis.

The blood smears from a child of 4 years, who gave a positive reaction to the tuberculin test, were examined during acute attacks in the upper respiratory tract. With each attack the total white count and polymorphonuclear neutrophils were but little disturbed. The monocyte-lymphocyte ratio was elevated from an actual increase in the percentage of monocytes and a decrease in the lymphocytes. Stimulated monocytes appeared at times. Roentgen examination showed perihilus infiltration. A positive tuberculin reaction resulted in a slight increase in neutrophilic leukocytes and monocytes and a decrease in lymphocytes, with a higher monocyte-lymphocyte ratio. This is a common observation in the blood.

The pathogenesis of recurrent hilus infiltration and the benign and retrogressive epituberculous infiltration may be related to a chemical constituent of the tubercle bacillus. Sabin and Doan found that the protein fraction produces a severely toxic condition, marked febrile disturbances and a neutrophilic increase. The phosphatid fraction was nontoxic and was associated with a rise of the monocytes and its derivatives, the epithelioid and Langhans giant cells. Of the two fractions, the phosphatid seems responsible for the conditions enumerated as well as for the changes described in this case.

Finally, consideration was given to a child, aged 13 months, who gave a negative reaction to 3 mg. of tuberculin; the child appeared normal physically, yet the blood counts showed a persistent increase in the number of monocytes. A brother, aged 4½ years, showed a markedly positive tuberculin reaction. According to the view that the monocyte is the host for the tubercle bacillus, an increased number of monocytes in the connective tissues and blood may possibly be considered as providing a ready vehicle for the dissemination of the organism. It might be worthwhile to determine whether monocytes appear in greater number in the peripheral blood of a race or family especially susceptible to tuberculosis. Experimentally, Sabin and Doan have found that rabbits whose blood had a high monocyte-lymphocyte ratio manifested a decreased resistance to experimental tuberculosis. The possible relationship which variations in the normal lymphocytosis of infancy and early childhood bear to the incidence of acid-fast infection after exposure is also worthy of consideration.

In summary, it may be said that the blood picture of a tuberculous infant or child may be interpreted in terms of the activity of the pathologic lesion.

In the tuberculosis of infancy and childhood, the neutrophilic leukocyte is in small degree the response to the formation of abscess, as in adults. In the main, it is associated with toxicity and spreading infection and may be related to the protein fraction of the tubercle bacillus.

The monocyte is identified with dissemination of the tubercle bacillus in the tissues and the lymphocyte with arrest and healing of the lesion.

The continued absence of the eosinophil from the peripheral blood in an acute case indicates a poor prognosis.

The blood picture reflects the activity of the tuberculous lesion and needs to harmonize neither with the clinical appearance of the patient nor with the roentgenographic observations.

The trend of the disease may be ascertained from a comparison of the numbers of polymorphonuclear neutrophils and eosinophils, lymphocytes and monocytes and from the monocyte-lymphocyte ratio, determined periodically. Consideration of prognosis must be guarded.

A Substance in Liver Active in Pernicious Anemia. Dr. Randolph West, New York.

Since Dr. Minot's demonstration of the efficacy of the liver diet in the treatment for pernicious anemia, attempts have been made to isolate the active material. After a long chemical preparation, a crystalline quinine salt of an acid was obtained last May which was clinically potent after three recrystallizations. After hydrolysis of the material from which this crystalline substance was made, β hydroxyglutamic acid and γ hydroxyproline were obtained. Whether these two substances represent the active material or there are other components yet to be identified only future work can determine. The two amino-acids mentioned may well function as precursors of the pyrrole ring in the body.

Intravenous Urography by Means of Iopax as Applied to Children. Dr. Moses Swick, New York.

In 1923, Rowntree and his co-workers of the Mayo Clinic were the first to attempt the visualization of the urinary tract by means of the intravenous as well as the oral administration of sodium iodide. Subsequent workers include Rosenstein and von Lichtenberg, Volkmann, Lenarduzzi and Pecco, Hryntschak, and Ziegler and Köhler. The latter investigators employed the additional use of compression. Finally, Roseno, who worked with a substance called "Pyelognost," was the first to achieve practical results, though they were associated with reactions.

This work was carried out with several compounds, synthetized by Professors Binz and Räth. One of them, applied in Professor Lichtwitz's clinic of Altona, Germany, at the request of Professor Binz, to combat streptococcus infections, was known as selectan neutral and was the first substance used for purposes of intravenous urography. Dr. Swick's experience with this drug brought out the need for a compound of greater tolerance and solubility. It was believed that the methyl group of this substance was responsible for the toxic manifestations. With this objective in view, he continued the work at the clinic of Professor von Lichtenberg in Berlin. Two modifications belonging to the selectan group of Professors Binz and Räth were tested and found unsuitable. Finally, when a compound containing a sodium acetate radical substituted for the methyl group of the selectan neutral was furnished, the clinically successful substance known as iopax (5-iodo-2-pyridon-N-acetate of sodium) was obtained. Iopax was found to fulfil the needs, and satisfactory urograms could then be obtained.

Iopax is an organically bound iodine compound (42.2 per cent of iodine), nontoxic, soluble in water and neutral in reaction, and has an exceedingly great tolerance. Three grams of the substance in 40 per cent concentration per kilogram of body weight can be administered to a rabbit without producing toxic manifestations.

The substance as such can be recovered from the urine by the addition of a mineral acid, yielding the insoluble acid state. Because of the relative simplicity and accuracy of the quantitative determination of the recovered substance, it has been considered feasible to apply a gravimetric method as a test of renal function. It is not assumed that this test is superior to other tests of renal function, but it is advocated merely as a confirmatory aid and adjuvant in the interpretation and evaluation of the roentgen results.

Laboratory observations have led to the identification of the recovered substance and to the fact that it is quantitatively recovered. For purposes of the test, from four to five two hour specimens of urine are collected. Each specimen is treated similarly. Acid is added to the urine until precipitation is complete; the sediment is recovered by suction on a Buchner funnel, washed with distilled

water until free from the precipitating agent, dried and weighed. Normally, from 85 to 95 per cent of the substance can be recovered from the urine within from eight to twelve hours after the injection. From the results already obtained, it is observed that the normally functioning kidney possesses the ability to excrete this substance in a relatively large quantity within a given short period. This may be characterized as "the thrust excretion ability" of the normally functioning kidney, present during the first two hours. To illustrate, from about 45 to 65 per cent of the total precipitable acid is recovered during the first two hours; from about 20 to 33 per cent during the next two hours, and the remainder during the subsequent hours. Two slides were shown to demonstrate in the case of normally functioning kidneys the "thrust excretion" on which good visualization is dependent, and a case of poorly functioning kidneys with a low level type of excretion.

Because the method of intravenous urography is one of excretion, one is compelled to consider this subject, though only in a general way, from the standpoint of renal function. For roentgenologic visualization, a definite concentration of the shadow-producing element, in the case of iopax, the iodine component, is necessary. When that concentration is wanting, there may be poor or no visualization. Under normal conditions, subsequent to the "thrust excretion" period, there is poor or no visualization, though substance is still being excreted during the later periods. However, in the presence of an obstructive factor, despite the presence of a reduced level of excretion, one may obtain good visualization, though usually at a much later period.

In the face of the foregoing general principles, one unexplainable example must be considered: A woman, aged 54, who complained of pain in the back and the region of the left kidney, by intravenous urographic examination showed good visualization on the left side but none on the right. A huge shadow observed in the right upper quadrant was thought to be a nonfunctioning kidney on the basis of tumor. Cystoscopy and retrograde pyelography, however, revealed normal excretion of indigo carmine (sodium indigotindisulphonas) from both sides and the presence of a sacral kidney on the right. In order to check this discrepancy, another intravenous urogram was done two and one-half weeks later; again the normal left side was visualized, whereas the right pelvis of the kidney was again not visualized, though the right ureter in the bony pelvis could be distinctly seen. This example illustrates the need for caution in passing final judgment on the functional activity of the kidney by this method alone.

Moreover, it is important to bear in mind that the mere nonvisualization at a given examination does not necessarily denote permanent renal damage. The functional activity may be temporarily inhibited. One case was demonstrated to illustrate this point.

Before passing from this phase, which has been touched on only superficially, Dr. Swick added that it is important to consider the intravenous method one of excretion, and that in order properly to evaluate and correctly to interpret the results obtained therefrom, one must bear in mind the renal and extrarenal factors determining renal function.

Children receive the following doses of the 40 per cent concentration: children of 13 years, 30 Gm.; children of from 9 to 13 years, 25 Gm.; children of from 6 to 9 years, 20 Gm.; children of from 4 to 6 years, 16 Gm.; children of 2 years, 14 Gm., and children of from 6 months to 2 years, from 10 to 12 Gm.

The substance is added in small amounts to doubly distilled warm water; the resultant solution is filtered twice through ordinary filter paper into a clean flask, which is stoppered with fresh wax paper. It is then sterilized in a water bath or is autoclaved for half an hour. The syringe method is employed in preference to that of gravity. A sufficient number of syringes plus needles are sterilized in distilled water. The injection is carried out in two stages at intervals of from three to five minutes. The patients experience a feeling of generalized warmth and thirst during the injection. In two cases vomiting has occurred; at times pain up the arm of injection is experienced. These symptoms, however, are of transient duration. Iodism has never been observed.

Compression over the region of the bladder by means of an air-inflated balloon maintained for from five to ten minutes previous to and during the taking of each plate has been found to improve considerably the density and clarity of the roentgen shadows. An additional plate without compression may be taken. It is wise to have the patient empty the bladder after the second or third roentgenogram has been taken. The first roentgenogram is taken about fifteen minutes after the last injection; the second, third and fourth are taken at intervals of approximately twenty-five minutes. When the function is poor or when there is a late visualization, it is advisable to have additional plates taken at intervals of from one to three hours to determine definitely the presence of no visualization or of a late visualization.

Intravenous urography yields a bilateral urogram. In the cases in which for mechanical or infectious reasons cystoscopy and retrograde pyelography are either impossible or dangerous, the application of this method becomes apparent. The method is of great assistance in cases of bleeding, in persons in whom instrumentation is taxing and harmful, in children and in cases of congenital malformation.

In cases of uremia or latent uremia, in which the concentrating power of the kidney is poor, the method is contraindicated and may even be dangerous. Under these circumstances little or no anatomic data will be obtained. To determine the functional state, simpler and less expensive methods, such as determinations of the blood urea and the phenolsulphonphthalein, can be resorted to. It is therefore advisable to precede the intravenous urographic examination by such determinations.

A series of slides of adults and children was demonstrated to illustrate the results obtained by this method, its field of application and its shortcomings.

In closing, Dr. Swick stated that experience with intravenous urography is only of fifteen months' duration. Also, in spite of the more than twenty years of existence of retrograde pyelography, the latter method is still associated with failings. Moreover, it is felt advisable to view this method as one of diagnostic aid and nothing more, and as such not without its imperfections. One's approach to the subject should be with caution and reserve, at least until experience from larger clinics with this particular method of investigation is reported on a far larger scale. In the cases in which retrograde pyelography fails, intravenous urography may be of assistance. Similarly, in cases in which intravenous urography fails, retrograde pyelography may be of great aid. In any event, when the results with intravenous urography are not absolutely definite and clear, one should not neglect the other methods of investigation.

A Consideration of the New Antirachitic Agents. Dr. Alfred F. Hess.

It is only about ten or twelve years since the question as to whether or not cod liver oil was of value in protection from and cure of rickets was raised; in other words, whether there was a specific therapeutic agent for the disorder. About that time, Cushny, the celebrated pharmacologist of Edinburgh, wrote that cod liver oil was of no value in rickets, and that it should not be considered a drug, but was merely a food, a substance rich in fat, which happened to be markedly assimilable.

A few years later, as the result of experimentation on animals it was shown that cod liver oil was a specific antirachitic agent (this is a good illustration of how progress is made). As in the case of all specifics, it does not work in every case.

Such was the status ten or twelve years ago. Today one is faced with just the contrary condition. There are a multiplicity and superfluity of antirachitic agents, so that the question now is which one is the best. There are cod liver oil, direct irradiation of the patient by means of the ultraviolet rays and, since the past three years, irradiated ergosterol, which can be given as such, or can be incorporated in milk. In addition, there are the irradiated foods, such as irradiated milk or cereals. The questions are, which of these should be used, and which will best protect and cure patients with rickets without doing injury to the infant?

Dr. Hess spoke of the infant, because the question has not been settled as to whether or not the adult requires the so-called antirachitic vitamin or antirachitic factor. He did not think that it has been determined whether adults can thrive permanently without any of this factor, either given by mouth or obtained by means of the solar radiations. It may be said in brief that studies on the metabolism have shown no marked effect on the calcium, phosphorus or nitrogen balance as the result of irradiation.

One observation has been made that seems, perhaps, to point to the need of this substance, and that is one by Stapleton, in India, in connection with osteomalacia, which usually comes about in association with pregnancy. She reported a considerable number of cases, perhaps thirty, in which osteomalacia developed in the women who observed the rite of purdah; in other words, in those who stayed indoors almost all of the time, and whose faces and bodies were completely covered when they went outdoors. Thirty cases occurred in young women who were not pregnant, and who had either reached the age of maturity or were slightly younger. These cases may be interpreted as showing that if a person gets no sunlight, or antirachitic factor, the nutrition of the bone will suffer.

One of the first things that one has to consider in connection with new drugs is the old principle of "non nocere," to do no harm to the patient. During the past few years, the literature has contained many reports of damage to animals, as the result of giving irradiated ergosterol. These experiments have been carried out mainly on rabbits, and the lesions have been principally calcification of the vessels of the wall of the heart and some calcification in the lungs and other organs. Dr. Hess believed that these reports, and especially the publicity that has been given them, have done undeserved harm, and have been unjust to the therapeutics of irradiated ergosterol. In the first place, the rabbit is hardly the animal on which to test these drugs. The rabbit has a marked lack of equilibrium for calcium, the one salt in the blood that has a marked stability. In man, dogs, cattle, horses, rats and almost every animal, for various reasons, the concentration of calcium is 10 mg. per hundred cubic centimeters of blood. That is not true of any similar salt; for instance, it is not true of sodium, potassium or phosphorus. In rabbits, the calcium rises, for one reason or another, to 15 mg. or more per hundred cubic centimeters, which renders it an unsuitable animal for these tests. Moreover, calcification of the vessels develops spontaneously in rabbits.

A further criticism of these tests, one much more serious, is, as has been brought out so often in the literature, that very large amounts of irradiated ergosterol have been used in order to produce the lesions in animals, thousands of times the normal therapeutic dose being used.

One of the things that led to criticism was that the first preparation of irradiated ergosterol, the German, was far too potent. The mistake was made in that instead of making the dose of a new drug weak and then increasing it if necessary, it was set very high and, therefore, had to be reduced. During the course of a year or more, a new preparation has been marketed which is about a tenth as strong as the old preparation. Since the weaker solutions have been in use, one hears little of a toxic reaction. This toxic effect not only acts on the vessels, but shows itself in the blood as hypercalcemia. The calcium may rise to 15 mg. or more. If the drug is then discontinued, the calcium falls, the child being injured.

The hypercalcemia may be combated by intravenous injections of sodium bicarbonate. If one injects 5 or 10 cc. of a 5 or 10 per cent solution of sodium bicarbonate, within a few hours the calcium falls almost to normal, and it is precipitated into the tissues; it is not excreted in the urine and feces.

Although the German preparation was made about one-tenth as strong as the first preparation, it was still about two and a half or three times as potent as the American preparations. The American solution will now be increased two and a half times. In other words, it will be approximately the same as the German preparation.

Dr. Hess said that during the last two years he had not met with a case of hypercalcemia, although he had used the preparation in his institution throughout the winter on a large number of infants; in no case did the calcium rise above 11.5 mg. It may be stated, therefore, that under present conditions the preparation can be used with safety. Moreover, during that period several children died of various ailments, more particularly pneumonia, and their organs, especially the vessels and the kidneys, were carefully examined, and no calcification was found in any case.

Why is it that one no longer meets with hypercalcemia, although one uses approximately the same dosage of the American product that one did some years ago? Dr. Hess said that as far as he knew there had been only one change in the preparation of irradiated ergosterol. At first, ergosterol was activated by means of the mercury vapor lamp. In the last year or two, use has been made of the carbon arc lamp. It is possible that this source of energy produces a less toxic preparation. In this connection, although one speaks of irradiated ergosterol as if it were a simple preparation, it is well known and has been recognized by various workers that it is composed of a combination of several substances. In the course of irradiation, there is a photochemical reaction during which several substances are formed. So that when one gives irradiated ergosterol one is giving some ergosterol that has not been acted on, some that has been changed to one stage, some that has gone on one or two stages further and, probably, some that has already been inactivated by overirradiation.

The main question has therefore been that of the standardization of these preparations. At first, the gravimetric method was used. About 0.5 mg. was given. It was clear from the beginning, or soon after antirachitic experiments were undertaken, that this method would not hold and that 0.5 mg. of a German preparation, 0.5 mg. of an American preparation and 0.5 mg. of a French preparation meant different things. In fact, 0.5 mg. of preparations from the same country sometimes differed greatly from each other. Another method was resorted to, and a comparison was made with cod liver oil. It was stated that the standard solutions on the market were 100 times stronger than cod liver oil.

This method of standardization postulated that this substance has the same action on rats as on infants. Recently, however, it has been found that such is not the case, and that infants require much more of the substance than rats. An infant requires about sixty times as much irradiated ergosterol as a rat, and about twenty times as much cod liver oil in order to acquire protection. In the rat the ratio of irradiated ergosterol to cod liver oil is about 3:1. In infants, the ratio is about the same. About three or four times as much irradiated ergosterol is needed as one would expect, judging from the results of the tests on rats. Dr. Hess cited an experience which illustrated this fact. Infants were given 20 drops of irradiated ergosterol, which is supposed to be equivalent to about 10 teaspoonfuls of cod liver oil. Mild rickets developed in several of the infants who were getting this amount. It was clear that rickets would not have developed had the infants received 10 teaspoonfuls of cod liver oil. It was then shown by means of comparative tests that the infants had to be given about three or four times as much irradiated ergosterol as one would expect, judging from the results of the tests on rats. This does not indicate that irradiated ergosterol is less valuable; it means merely that the dosage of irradiated ergosterol must be larger than was first thought and that the test based on the comparison with cod liver oil is not valid.

The tests will probably be changed so that instead of stating that a certain irradiated ergosterol is so many times, for instance, 100 times, more potent than cod liver oil, the potency will be given in rat units. This may be calculated, as is done in some laboratories, according to protective units, or according to curative units. The better of these two methods has not yet been determined.

The question arises as to why three or four times as much irradiated ergosterol has to be used. Dr. Hess said that he did not think that this difference was due to the content of the fat-soluble vitamin in cod liver oil. As is known, irradiated

ergosterol contains no fat-soluble vitamins, while most of the preparations of cod liver oil are rich in this factor. It was his opinion that cod liver oil probably contains some other antirachitic factor.

It is clear that if such were the case, it might be of advantage to give irradiated ergosterol and cod liver oil, in other words, a fortified cod liver oil. There is such a preparation on the market made by several firms. The dose is 1 teaspoonful of cod liver oil and one-half the standard dose of irradiated ergosterol. In this way, the patient receives irradiated ergosterol, the hypothetic factor and the fat-soluble factor. A large series of tests has not been carried out with the fortified cod liver oil, but it is possible that it may turn out to be the therapeutic measure of choice.

In addition to irradiated ergosterol and ergosterol in cod liver oil, there are the irradiated foods, more particularly irradiated milk. It is natural to wonder whether this might not be the best method to prevent rickets, to do away with rickets as a communal disorder. If all the milk for infants could be satisfactorily irradiated, there would be few, or very mild, cases of rickets. This measure has been carried out by some municipalities, namely, by Frankfurt and Basle. When Dr. Hess was in Frankfurt last summer, he investigated how the procedure was working. In a hospital he saw a small apparatus, which delivered about 80 quarts an hour, and in a dairy he saw one that irradiated milk on a large scale.

It seems that there are many technical difficulties that will have to be met. In the first place, one has to be careful that none of the milk gets on the burners. Dr. Hess said that he had had that experience a couple of years ago, so that the milk was found to have about half the potency it should have had. When the mercury burners were examined, it was found that there had been carelessness in the course of the irradiation, and that the burners were not clean. Pfaundler, in Munich, had a similar experience. Of course, this difficulty can easily be rectified.

Burners vary greatly in intensity, and they lose their intensity at different rates, depending on the fact that the quartz loses its permeability and that the vacuum in the tube is no longer absolute, so that if a dozen or more lamps are tested it may be found that they are furnishing ultraviolet irradiations of different intensities, which will produce irradiated milk of varying potency.

There is another factor in connection with irradiated milk. In the course of irradiating milk, one must not forget that one still has to be careful of bacterial contamination. In large plants workers will have to be careful, as they are in pasteurizing plants, that the pipes and apparatus through which the milk flows can be carefully cleaned.

Dr. Hess said that he believed that these mechanical difficulties will be overcome. It has been shown that irradiated fluid and irradiated dry milk will largely protect against rickets, when 1 pint a day is given. Of course, they will vary in the individual infant and according to the product.

Irradiated yeast may also be given. Ergosterol is obtained mainly from yeast. Originally, it was extracted from ergot, which accounts for its name. One can obtain as much as 2 or 3 per cent ergosterol from yeast. If yeast is irradiated, one gets a potent preparation. As Dr. Hess reported about five years ago, irradiated yeast has been used in Poland by Kon, who reported favorable results. It has recently been fed to cows in order to give the milk a high antirachitic value. Yeast is a cheap method of giving the antirachitic vitamin and has the advantage of giving also the vitamin B factor. There is a difference of opinion as to whether infants are receiving enough vitamin B in their food; if they are not, this is a simple method of giving them vitamin B and at the same time of protecting them against rickets.

Recently, irradiated cereals have been advocated. Dr. Hess did not think that they play any rôle in the therapy for rickets, for rickets usually develops by the sixth month of life. It probably begins to develop much sooner, at a time when infants do not get cereals or are receiving such small amounts that it can play

very little rôle. From the standpoint of rickets, Dr. Hess did not believe that irradiated cereal will ever be of value, although it might be of value for older children.

It is clear that irradiated ergosterol is a valuable preparation. Even though there may be some initial adjustments necessary in the use of these new preparations, it seems certain that they are here to stay in one form or another.

Dr. Hess said that he believed that a central bureau should be established to control these preparations, and that there should be supervision similar to that which is exerted over the antitoxins, so that the physician could be certain that the preparations were potent. He said that such control should be centered in Washington, D. C., as it is with various serums. At present there is a decided difference in the biologic method of obtaining these preparations. It seems that those who have had the least experience with biologic tests have the most confidence in them. Those who carry out such tests find that they differ greatly; although they are supposedly standardized by the same method, one preparation may be twice as strong as another. For instance, one may use rats of the same age and of the same breed, give them the same ration, and test them with the same preparation of irradiated ergosterol, but if the test is continued for from five to ten days one may have a preparation that is only half as strong as it was supposed to be. In other words, after five days there may be no healing, whereas if the test is prolonged to ten days the healing may be definite. If one laboratory uses the ten day test and another uses the five day test, one preparation may be 100 per cent more potent than the other.

It seems that perhaps the control should extend further, and that there should be an international control. A resolution to this effect was passed at the recent meeting of the International Pediatric Congress at Stockholm. A resolution was passed asking the Department of Hygiene of the League of Nations to investigate the question of standardization of these preparations and to institute definite standards and methods of control. When Dr. Hess was in Geneva and spoke to the authorities about the matter, they stated that they had the subject under consideration, and that they probably would undertake a control of antirachitic and other vitamin products.

Book Reviews

KONTROLLE DES MINERALSTOFFWECHSELS. By RAGNAR BERG. Price, 5 marks. Pp. 87. Leipzig: S. Hirzel, 1930.

In an introductory historical note the author reviews critically and in chronological order the various attitudes toward the problem of mineral metabolism from the time of Justus von Liebig to the present.

Newer methods of precision have added a large number of minerals to those known to exist in foodstuffs and in the animal organism.

The author points out that we are far from knowing definitely which elements are essential to the life of the animal organism. Not all elements are biogenous.

Little is known of the form in which these biogenous elements occur in nature. Is it immaterial in what form they are introduced, or is their assimilation dependent on a certain form or configuration of the chemical elements?

The organism does not seem capable of reducing an element of a higher stable valence to one of lower value or valence. It is not capable of reducing to more elementary form an element once oxidized, and also does not possess the capacity of hydrogenization.

The elements chlorine, bromine, iodine, fluorine, sulphur and phosphorus are fully discussed, particularly the manner in which they occur and are bound or combined in the organism.

It is pointed out that mineral substances do not occur in the human organism in isolated form, tied directly to organic substances, but rather as more or less oxidized elements.

The various forms of salts as they are found in the human organism are described, also the manner in which the minerals are combined in these salts and the functions they serve in this combination.

Acids, bases and salts are discussed in detail. The author points out the difficulty of defining these substances and differentiating them in mediums with present known chemical methods.

He regards the hydrogen ion determination inadequate as a differentiating method and explains it on the basis that ionization is really a physical and not a chemical constant. He regards the chemical characteristics and behavior of acids, bases and salts as the best measure and means of their identification.

The chief interest lies in the chemical change of foodstuffs in the process of digestion, absorption and assimilation. To determine such changes, chemical and not physical methods are required.

The author points out the difficulties of determinations of mineral metabolism and the difficulty in determining in detail both the intake and the output of minerals.

The control of the total balance, however, is possible, and this is of most importance. Fairly easy methods exist to control these total balances. These methods are described.

The origin of acids, bases and salts in the organism is described. Their complex reactions and interreactions and the manner in which they combine and are finally excreted from the body are explained in simple and easily understandable terms. The importance of the urinary reaction as a rough measure of determination whether a diet is adequate or inadequate from the standpoint of acid-base balance is given consideration.

The rôle of the phosphates in the development of acidity or alkalinity of urine is discussed.

The author discusses in great detail the value of determinations of the hydrogen ion concentration, both galvanometric and colorimetric, and points out the difficulties and possible errors one will encounter in both. In like manner the prepara-

tion and use of the four indicators, litmus, phenolphthalein, congo red and methyl orange, are fully described.

The rôle of the minerals in the body, the method in which minerals in elementary form or in salt combination are fused, dissolved or lodged in the tissues and their respective functions are fully gone into. It is pointed out that their fate is always the same in the vital reactions of the body, which is finally excretion in the form of acids or salts.

The essential importance of ionized salts for the functions of all organs is discussed. This is true of anions and in still greater measure of the cations, especially of potassium, sodium, calcium and magnesium.

The significance of acid-base relationship — their connection with the intake of food — the production of states of acidosis and alkalosis and their significance are fully discussed in a manner understandable for any one with even a moderate and elementary knowledge of biochemistry.

The author believes that a number of diseases depend on abnormal mineral metabolism and that in most cases it is doubtless deficiency in bases and a disturbance of relationship of individual cations.

The author suggests a base-rich diet and the use of ionizable salts as the logical remedies.

The monograph is readable, giving evidence on nearly every page of the author's own great contributions to the subject and putting before the reader in lucid, clear style, and almost narrative form, some of the most complex material of modern biochemistry.

LES INFANTILISMES. By E. APERT. Price, 20 francs. Pp. 69, with 2 plates and 18 figures. Paris: Gaston Doin, 1931.

The author classes as infantilism all conditions in which infantile characteristics persist abnormally. He discusses the history of these conditions collectively, and then describes in detail, thyroid disturbance, hypophyseal, suprarenal and renal infantilism, celiac disease, progeria, hepatosplenic infantilism, cardiac infantilism and Gandy's form. The descriptions are good, and the photographic illustrations are excellent. The final chapters are devoted to a résumé of the various pathologic considerations and a general discussion of the forms of treatment.

CARE OF THE INFANT AND CHILD. By H. R. LITCHFIELD and L. H. DEMBO. Price, $1. Pp. 138, with 14 drawings. Baltimore: Waverly Press, 1930.

There is nothing exceptional about this book to recommend it instead of the many other similar books for mothers published at the present time. The usual subject matter and procedures are followed. All of the descriptions and explanations are quite rational, and it is perfectly safe to add this to the list of books to recommend to a mother who wishes this sort of a text.

Directory of Pediatric Societies

INTERNATIONAL

International Pediatric Congress

President: Dr. George Frederic Still, 28 Queen Anne St., London, W. 1.
Place: London. Time: 1933.

NATIONAL

American Medical Association, Scientific Assembly, Section on Diseases of Children

Chairman: Dr. C. A. Aldrich, 723 Elm St., Winnetka, Ill.
Secretary: Dr. Alfred A. Walker, Highland Plaza Apartments, Birmingham, Ala.
Place: Philadelphia. Time: June 8-12, 1931.

American Academy of Pediatrics

President: Dr. I. A. Abt, 104 S. Michigan Ave., Chicago.
Secretary: Dr. C. G. Grulee, 310 S. Michigan Ave., Chicago.
Place: Atlantic City, N. J. Time: June, 1931.

American Child Health Association

President: Hon. Herbert Hoover, Washington, D. C.
Secretary: Dr. Philip Van Ingen, 125 E. 71st St., New York.

American Pediatric Society

President: Dr. Philip Van Ingen, 125 E. 71st St., New York.
Secretary-Treasurer: Dr. Howard Childs Carpenter, 1805 Spruce St., Philadelphia.
Place: Edgewater Gulf Hotel, Edgewater Park, Miss. Time: April 15-17, 1931.

Association of American Teachers of the Diseases of Children

President: Dr. Jacob V. Greenebaum, 19 W. 8th St., Cincinnati.
Secretary: Dr. Ralph M. Tyson, 334 S. 21st St., Philadelphia.
Place: Philadelphia. Time: June 8-12, 1931.

Children's Hospital Association of America

President: Dr. Joseph Brennemann, 707 Fullerton Ave., Chicago.
Secretary-Treasurer: Miss Bena M. Henderson, Milwaukee Children's Hospital, Milwaukee.
Place: Toronto. Time: September, 1931.

Canadian Society for the Study of Diseases of Children

President: Dr. E. A. Morgan, 160 Bloor St., Toronto, Ont.
Secretary-Treasurer: Dr. George E. Smith, 244 Bloor St., W., Toronto, Ont.

SECTIONAL

Central States Pediatric Society

President: Dr. A. Graeme Mitchell, 345 McAlpine Ave., Cincinnati.
Secretary: Dr. A. H. Parmelee, 310 S. Michigan Blvd., Chicago.
Place: Cincinnati. Time: Oct. 16-17, 1931.

Southern Medical Association, Section on Pediatrics

Chairman: Dr. D. Lesesne Smith, 188 S. Church St., Spartanburg, S. C.
Secretary: Dr. Ludo von Meysenbug, 3439 Prytania St., New Orleans, La.
Place: New Orleans. Time: November, 1931.

STATE

Alabama Pediatric Society

President: Dr. Hughes Kennedy, Jr., Highland Plaza Apts., Birmingham.
Secretary-Treasurer: Dr. John W. Simpson, 1117 S. 22nd St., Birmingham.

Georgia Pediatric Society

President: Dr. Benjamin Bashinski, Doctors Bldg., Macon.
Secretary-Treasurer: Dr. J. Cox Wall, Eastman.
Place: Atlanta. Time: May 12-13, 1931.

Louisiana State Pediatric Society

President: Dr. R. A. Strong, 1551 Canal St., New Orleans.
Secretary-Treasurer: Dr. Suzanne Schaeffer, Chailie Bldg., New Orleans.

Oklahoma State Pediatric Society

President: Dr. Carroll M. Pounders, 210 W. 10th St., Oklahoma City.
Secretary: Dr. C. E. Bradley, Medical Arts Bldg., Tulsa.
Place: Oklahoma City. Time: May, 1931.

South Carolina Pediatric Society

President: Dr. E. W. Barron, 1512 Marion St., Columbia.
Secretary-Treasurer: Dr. Julian P. Price, 117 W. Cheves St., Florence.

Texas Pediatric Society

President: Dr. L. O. Godley, Medical Arts Bldg., Fort Worth.
Secretary-Treasurer: Dr. P. E. Luecke, 4105 Live Oak St., Dallas.

Virginia Pediatric Society

President: Dr. W. B. McIlwaine, Petersburg.
Secretary: Dr. J. B. Stone, 2042 Park Ave., Richmond.

LOCAL

Academy of Medicine of Cleveland, Pediatric Section

Chairman: Dr. O. L. Goehle, 15701 Detroit Ave., Lakewood, Ohio.
Secretary: Dr. W. C. Fargo, 8314 Euclid Ave., Cleveland.
Place: 2099 Adelbert Road. Time: Four meetings, from September to May.

Academy of Medicine, Toronto, Section of Pediatrics

President: Dr. Gladys Boyd, 56 DeLisle St., Toronto.
Secretary: Dr. Lawrence Murray, 1870 Bloor St., W., Toronto.
Time: November 17, December 15, February 16 and March 15.

Bronx Pediatric Society

President: Dr. Joseph Golomb, 496 E. 175th St., New York.
Secretary: Dr. E. Leonard Benjamin, 2229 Valentine Ave., New York.
Place: Concourse Plaza, 161st St. and Grand Concourse. Time: Second Wednesday of each month, except June, July, August and September.

Brooklyn Pediatric Society

President: Dr. Benjamin Kramer, 6 Pierrepont St., Brooklyn.
Secretary: Dr. Lambert Krahulik, 172 Clinton St., Brooklyn.
Place: Kings County Medical Society Bldg. Time: Last Wednesday of each month, except June, July and August.

Central New York Pediatric Club

President: Dr. Frank Vander Bogert, 111 Union St., Schenectady.
Secretary: Dr. Frank J. Williams, 58 S. Swan St., Albany.
Place: Various cities in New York. Time: Fourth Thursday of October, January and April.

Chicago Pediatric Society

President: Dr. Arthur H. Parmelee, 310 S. Michigan Ave., Chicago.
Secretary: Dr. Bert I. Beverly, 8 S. Michigan Ave., Chicago.
Place: City Club. Time: Third Tuesday of each month.

Dallas County Pediatric Society

President: Dr. R. S. Usry, Medical Arts Bldg., Dallas, Texas.
Secretary: Dr. P. E. Luecke, 4105 Live Oak St., Dallas, Texas.
Place: Bradford Memorial Hospital. Time: 1 p. m., first and third Saturdays of each month.

Detroit Pediatric Society

President: Dr. Allan L. Richardson, 651 Fisher Bldg., Detroit.
Secretary: Dr. Joseph A. Johnston, Henry Ford Hospital, Detroit.
Place: Children's Hospital of Michigan. Time: No fixed date; approximately once a month.

Fulton County Medical Society, Pediatric Section (Atlanta, Ga.)

Chairman: Dr. James A. Wood, Medical Arts Bldg., Atlanta.
Secretary: Dr. Roger W. Dickson, 33 Ponce de Leon Ave., N.E., Atlanta.
Place: Academy of Medicine, 32 Howard St. Time: Second Thursday of each month from October to April, 8 p. m.

Memphis Pediatric Society

President: Dr. Kinsey M. Buck, 1024 Madison Ave., Memphis, Tenn.
Secretary-Treasurer: Dr. R. B. McCormick, 1074 Madison Ave., Memphis, Tenn.
Place: Memphis General Hospital. Time: Second Tuesday of each month.

Milwaukee Pediatric Society

President: Dr. H. O. McMahon, 84 E. Wisconsin Ave., Milwaukee.
Secretary: Dr. F. R. Janney, 2018 E. North Ave., Milwaukee.
Place: Children's Hospital. Time: Second Wednesday of each alternate month, beginning with February.

Nebraska Pediatric Society

President: Dr. H. B. Hamilton, 434 Aquila Court Bldg., Omaha.
Secretary: Dr. George L. Clark, 1817 Vinton St., Omaha.
Place: As announced by committee. Time: Second Thursday of each month from October to June, inclusive, 6 p. m.

New England Pediatric Society

President: Dr. Elmer W. Barron, 520 Commonwealth Ave., Boston.
Secretary: Dr. Gerald Hoeffel, 319 Longwood Ave., Boston.
Place: Boston Medical Library. Time: October, January and March.

New York Academy of Medicine, Section of Pediatrics

Chairman: Dr. Hugh Chaplin, 39 E. 75th St., New York.
Secretary: Dr. John P. Caffey, Babies' Hospital, 167th Street and Broadway, New York.
Place: New York Academy of Medicine, 2 E. 103d St. Time: Second Thursday of each month from October to May, inclusive, 8:30 p. m.

North Pacific Pediatric Society

President: Dr. Eber D. Kanaga, Townsend Bldg., Tacoma, Wash.
Secretary: Dr. Homer T. Clay, Washington Bldg., Tacoma, Wash.

Northern California Pediatric Society

President: Dr. Edward B. Shaw, 384 Post St., San Francisco.
Secretary-Treasurer: Dr. Lloyd Hardgrave, 384 Post St., San Francisco.
Place: Various teaching schools. Time: Monthly.

Northwestern Pediatric Society

President: Dr. E. S. Platou, Medical Arts Bldg., Minneapolis.
Secretary: Dr. F. G. Hedenstrom, 625 Lowry Bldg., St. Paul.
Place: Minneapolis. Time: April, 1931.

Philadelphia Pediatric Society

President: Dr. John P. Scott, 2040 Pine St., Philadelphia.
Secretary: Dr. John D. Donnelly, 115 Bryn Mawr Ave., Bala, Pa.
Place: College of Physicians, 19 S. 22d St. Time: Second Tuesday of each month from October to June, inclusive.

Pittsburgh Pediatric Society

President: Dr. David H. Boyd, 200, 9th St., Pittsburgh.
Secretary: Dr. Theodore O. Elterich, 724 Highland Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine. Time: Second Friday, alternate months from October to April, inclusive.

Richmond Pediatric Society

President: Dr. Basil B. Jones, 2618 Grove Ave., Richmond, Va.
Secretary-Treasurer: Dr. John S. Weitzel, 3103 W. Franklin St., Richmond, Va.
Place: Westmoreland Club, 601 E. Grace St. Time: First Thursday of each month (other than during the summer).

Rochester Pediatric Society

President: Dr. John Aikman, 184 Alexander St., Rochester, N. Y.
Secretary: Dr. Howard F. Rowley, 176 S. Goodman St., Rochester, N. Y.
Place: Arranged by program committee. Time: First Friday of each month from October to May.

Rocky Mountain Pediatric Society

President: Dr. Wilford W. Barber, 227, 16th St., Denver.
Secretary: Dr. John A. Schoonover, 1616 Tremont Pl., Denver.
Place: Children's Hospital, Denver. Time: Third Saturday of each month from September to May, inclusive, 2:30 p. m.

St. Louis Pediatric Society

President: Dr. Gustave Lippmann, 3720 Washington Blvd., St. Louis.
Secretary-Treasurer: Dr. Katherine Bain, 3720 Washington Blvd., St. Louis.
Place: St. Louis Children's Hospital. Time: At least once a year and contingent thereafter on the arrangement of a suitable program.

Seattle Pediatric Society

President: Dr. Herbert E. Coe, 509 Olive St., Seattle.
Secretary: Dr. Raymond H. Somers, 1305, 4th Ave., Seattle.
Place: College Club. Time: Third Friday of each month, 7 p. m.

Southwestern Pediatric Society

President: Dr. William S. Bowers, 1136 W. 6th St., Los Angeles.
Secretary: Dr. Fred L. Glascock, 1136 W. 6th St., Los Angeles.
Place: University Club of Los Angeles. Time: First Wednesday in January, March, May, September and November.

University of Michigan Pediatric and Infectious Disease Society

President: Dr. E. P. Russell, Berwyn, Ill.
Secretary: Dr. John P. Parsons, 320 S. Division St., Ann Arbor, Mich.

THE AMERICAN JOURNAL OF DISEASES OF CHILDREN is published by the American Medical Association as a means for the advancement of knowledge of the diseases of children and for the publication of scientific investigation in this field.

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